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The Economics of Production

I—DEMAND AND PRODUCTION

By Prof. D. A. McCabe, Ph.D.

With introduction by Ernest F. DuBrul, General Manager, National Machine Tool Builders' Association

Five hundred and nineteen million dollars was the amount of money lost by failures in the United States for the last twelve months. This loss did not include stockholders' losses in concerns that were financially wrecked, but managed to keep out of court by reorganization and refinancing. Nor do these losses include the sacrifice of high cost goods sold on a declining market below the cost of production. How much more the latter classes of loss would amount to would be difficult to say, but it would not be surprising to find it more than twice the failure loss. A large part of all these losses is due to ignorance in low and high places; ignorance of very simple and easily understood facts and principles.

> What makes the producer's lot a hard one at times is that he must frequently prepare to meet the dictates of demand before he knows what those dictates are. That is, he must set his production in motion in anticipation of the demand. He must decide what to produce, and how much of it to produce on the basis of his judgment of what the demand will be when the goods are ready, and if he overestimates the demand, he is liable to have to suffer heavily for his mistake. It is not too much to say that in our day it is the estimated demand that controls the character and volume of production.

Not long ago it would have been strange to find in a technical journal articles written by a professor of economics explaining the fundamentals of economic theory. Technical journals have been largely devoted to questions of production, with some collateral matter devoted to the marketing of the product. But it is now realized that production men, as all others, ought to know something about the "WHY" of production. Some very distinguished engineers have recently been promulgating a formula to the effect that "The end of business must be service, not money; production, not profit." This half-baked gospel is gaining ground among men who seem to have given very little study to a few basic, human facts. The continued existence of these facts is evidence of the fallacious reasoning of these new apostles.

Any one with an elementary knowledge of business facts knows that the sole object of business is profit. If it does not make a profit, it dies. It can have no other object, and this one object can be realized only through service. The new apostles of service mistake the means for the end. The motto of a widespread business organization reads, "He Profits Most Who Serves Best." That motto is no meaningless shibboleth, rather it expresses a cold, hard fact. But if one tried to serve without profit, he would soon find his service ended.

Articles like Prof. McCabe's series are desirable to have in every medium reaching men engaged in business in any capacity, whether in production, marketing, or finance. Too many business failures are due to violation of these simple, underlying laws that are just as inevitable as the law of gravity, and just as inescapable. All business men should know these laws, and instead of trying to work against them, should try to work with them. Then the world would have more goods produced for the satisfaction of human wants, it would get better service from that production; and the business men responsible for the production would profit more by the better service.

If more salaried men and wage workers knew the same simple principles, it would be easier for business administrators to apply the principles at the right moment, and not be compelled to wait as long as they now must; to the great cost of everybody. As a result business would be less irregular, and employment would be steadier because all business would be running on a more even keel.

What causes business depressions? At bottom it is a maladjustment of demand and supply. This maladjustment occurs because not enough people know the workings of the law of supply and demand, and its effect on prices and costs. They do not know what these terms actually mean in describing basic business facts. They vaguely feel that the law of supply and demand does its work in some automatic, impersonal way just as does the law of gravity. They do not realize that human wills, motivated by certain desires to make profits or avoid losses, make the law of supply and demand act just as inevitably and inescapably as the law of gravity. But it is not automatic. No price moves by itself, but whether it moves up or down, some human will makes it move to the higher or lower plane. This movement may affect the welfare of hundreds or thousands of human beings, because of the action of one single will. How and why prices move is still a mystery to most of the men who move them.

Articles like Prof. McCabe's, dealing with these simple fundamental facts—demand, supply, price, and cost—articles written in the ordinary language of business, should greatly help to stimulate desire to know economic laws better. If, and when, men grossly violate economic law, they punish themselves. Economic law does not tolerate ignorance; it cannot be violated

with impunity any more than can the laws of health, or any other natural laws. Every one earning a living, or spending money earned by himself or others, is subject to the workings of economic law. The more of us who know just how economic law works, the better off all of us are going to be. The more a man knows about watches the less inclined he is to want to take his own apart and rebuild it when it stops ticking. He knows that rewinding is generally the best cure for his trouble.

ERNEST F. DUBRUL.

IT IS a matter of common observation that in our day and country production is carried on with the expectation of selling the goods produced. Some people, farmers for example, produce to some extent for their own consumption, but the great bulk of goods produced in this country are produced with intent to sell. These are produced because those who are responsible for the production of them expect that people will be willing to buy their products. It is this willingness to buy that we have in mind when we speak of "demand".

Demand has a very important relation to production. It is the demand that decides finally what goods shall be produced and in what quantity. Off hand it might seem that the producers, the employers, decide that. Legally they do, but in the decisions that they arrive at they must be obedient to the wishes of the buyers as indicated in the demand for goods. Those producers who insist on producing goods for which there is no demand at a profitable price soon cease to be producers and their places are taken by men who are more obedient to the dictates of the demanders.

What makes the producer's lot a hard one at times is that he must frequently prepare to meet the dictates of demand before he knows what those dictates are. That is, he must set his production in motion *in anticipation* of the demand. He must decide what to produce, and how much of it to produce on the basis of his judgment of what the demand will be when the goods are ready, and if he overestimates the demand he is liable to have to suffer heavily for his mistake. It is not too much to say that in our day it is the *estimated demand* that controls the character and volume of production.

Demand is not, of course, the only requirement for production. Demand alone does not call forth production like a fairy godmother waving a wand. Machinery, raw materials, labor, etc., must be available and the funds must be on hand with which to secure them. A withdrawal of credit, an inability to secure equipment or labor or materials may bring production to a stop or check its speed. But even if these things could be obtained and there were no demand, there would not long be production for sale. It is in this sense that demand is essential to production, and exercises control over the kinds and quantities of things produced.

Demand may be large or small, good or bad. There is a vast difference between a good demand and *some* demand that barely escapes being no demand at all. The thing that concerns the producer practically is whether the demand is strong or weak, increasing or decreasing. What is meant by a "good" demand? Is it a demand for a large quantity, or a willingness to pay a high price? It is both. The demand can be described intelligently only in terms of both price and quantity. It is necessary to know both of these items in the demand for any commodity before we can say whether it is good or bad, increasing or decreasing.

First, as to price. We must know the price at which people are willing to buy before we know anything of practical importance about their demand. It is not enough to say that people are willing to buy cotton; we must ask at what price they will buy it. Does their willingness to buy mean willingness to buy at ten cents a pound, or will their willingness survive a request for fifty cents a pound for cotton? Does the willingness to buy pig iron assume that pig iron will be offered at fifteen dollars a ton or at forty-five?

We must also know the *quantity that will be taken* at the price suggested in order to judge the strength of the demand. Even though the price be satisfactory to the producers, if the quantity demanded at that price is small the demand is not strong. A total demand for but one-quarter of the capacity of the steel mills in a given year is a poor demand for steel billets even at a price of sixty dollars a ton; just as a demand for the whole capacity is a poor demand if it is conditioned on the very low price of fifteen dollars a ton. A good demand is one which calls for a large quantity at a good price. Both items, quantity demanded and the price at which it is demanded, must be known in order to gage the strength of the demand.

The next characteristic of demand that we have to note is that at any given time there are many different "quantities demanded," and they vary according to the price suggested. There is no one fixed amount demanded regardless of the price. There is one quantity at one suggested price and quite a different quantity at another suggested price. Therefore, in order to describe fully the demand for a particular commodity at a particular time, we must state what the quantity taken would be at each of the possible prices worth considering. The demand can best be represented in a schedule or table showing the several possible prices and the various quantities demanded that correspond with them. For illustration:

Suggested Price	Quantity that Would Be Taken if the Figure Opposite Were the Price
$0 90	1,070,000
95	1,040,000
1 00	1,000,000
1 05	950,000
1 10	920,000

It will be noted in the above illustration that the amount demanded is greatest at the lowest suggested price (90 cents) and smallest at the highest suggested price ($1.10). In fact at any price suggested the amount is smaller than it is at any lower price. These particular figures are not actual, but made up merely for purposes of illustration. It is generally true, however, of the demand for any commodity: that a higher suggested price is accompanied by a smaller demand in quantity, and a lower suggested price by a demand for a greater quantity. This is another way of saying that you can sell a larger quantity at a lower price, whereas if you ask a higher price you cannot sell such a large quantity, under normal circumstances. *This is a general rule as to demand—that at any given time the amount demanded is larger or smaller accordingly as the price suggested is lower or higher.*

There are times when the lowering of the price of certain goods does not lead to an increase in the amount of those goods demanded. These are exceptional cases. Some times the possible buyers may believe that the price is artificially high and will hold off from buying in the expectation that the price will have to be lowered. If the price is then lowered slightly, they may take the lowering of the price as a proof of their belief that

the price cannot be maintained and instead of buying more will be strengthened in their determination not to buy until the price is further reduced. Not until the price has been reduced to what the possible buyers regard as its probable bottom point will the price reductions, under such circumstances, stimulate greater buying. But this is an unusual condition of demand. It is likely to be found only after prices have swung so far upward that a downward movement is generally expected, a condition which has been strikingly illustrated during 1921.

Goods differ, too, as to the degree in which the amount demanded will respond to a change in the price at which the goods are offered. The demand for goods that are necessities, like salt, and goods that are widely consumed as a matter of habit, like common grades of tobacco, does not show wide differences in the amount demanded even with considerable differences in the price asked. Window glass is another example. The amount demanded is affected far more by other factors, as for example, the amount of building. This is determined by such prices as the prices of building materials and the wages of building labor, rather than the price of a single small element like window glass. On the other hand, the demand for certain other classes of goods will show a considerable expansion or contraction in the amount demanded with a small difference in the price asked. Luxuries, as a rule fall into this group. But whether the differences in the amounts demanded are great or small with differences in the prices under consideration, the general rule remains that there is *some* difference.

This characteristic of demand influences in an important way the amount of each commodity produced. Producers have to adjust the volume of their production in accordance with this rule if they are not to "overproduce." The expectation that leads them to set production in motion is that they will be able to sell their goods at a price at least high enough to return them their costs plus a profit that will make it worth while for them to produce. If they produce too much they will not receive that price, but will be compelled to accept a lower price, if they sell at all. This is "overproduction." The producers must decide on the quantity to produce in the knowledge that the greater the quantity produced, the lower will the price have to be if the total output is to be sold.

We have now discussed the nature of demand and the measurement of its strength or weakness *at any given time*. The meaning of changes in demand, the measurement of such changes, and their effects on production will be taken up in the next article.

Carbon and Other Motor Troubles

By I. B. Rich

The time is fast approaching when the motor butcher of the past must give way to the real mechanic, who can and will turn out a dependable job. The real mechanic must study motor conditions as he finds them and correct the builders mistakes, which too often occur. And this means that he must study motor theory, at least to some extent.

One of my friends is an expert on motor repairs, or I should say motor renewal or conditioning. He does not handle ordinary "fixing" jobs, but when a man's motor isn't behaving properly—or needs a real overhauling, he gets the work for miles around.

One of his specialties is pistons and he's an expert on piston trouble diagnosis. The first thing he looks at in a piston is the inside of the head. He does't bother so much about the carbon on the outside, because that is a matter of leakage past the rings. But carbon on the inside is a different story, and it is affected by the heat conducting properties of the piston head.

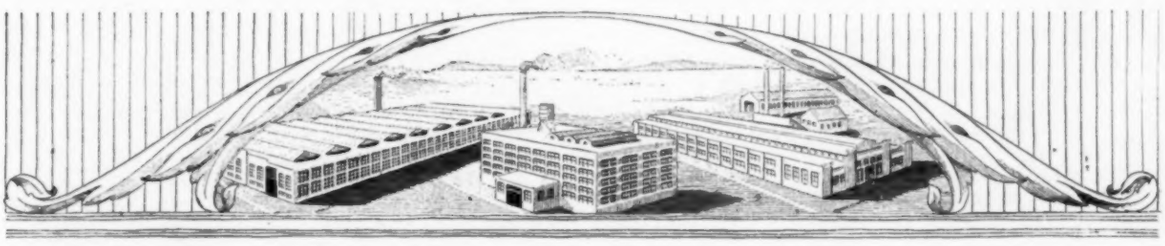
If he finds carbon on the inside of the piston head he makes new pistons, usually with a little thinner head. For when carbon forms rapidly on the inside of the head it gets knocked off by the explosions, falls into the crankcase oil and doesn't improve the bearings a particle. He also examines the bearings and if he finds them a sort of silvery color instead of brightly polished, he knows there is carbon mixed in the cylinder oil and that it can only come from formations inside the piston. By properly proportioning the head of the piston, he eliminates this difficulty.

He also has a piston ring practice all his own. He believes in four narrow rings, above the piston pin. Rings below the pin or in the skirt have no value in his opinion. Light tension rings are used as in Rolls-Royce practice, with say 1½-lb. spring tension as against some rings which run up to 12 pounds. With a cylinder as round as possible, the lighter the pressure the better. Racing cars frequently have but two rings and occasionally only one, as piston ring friction is sometimes as high as thirty-five or forty per cent of total motor friction. But for service, four light rings fill the bill, according to his experience.

In grinding cylinders he uses a wheel which heats the work to some extent so as to get the cylinder block as nearly the working temperature as possible. This gives an approximately round hole under working conditions, whether it is round when cool or not, and is better that way.

He also studies the weight of pistons very carefully and finds that an ounce or so on a piston makes a great difference in the motor at high speeds. So he favors aluminum alloys when a suitable mixture is used. When it comes to aluminum connecting rods, however, he is still from Missouri. The steel rod can be made very light at the piston pin end, which is the end that counts as a reciprocating part. The shaft end, where the weight is, comes into the revolving class.

These are some of the problems for the real automobile mechanic to consider carefully. The "auto fixer" is the descendant of the old livery stable clan and, like his predecessor, bound to go the way of all outgrown individuals and industries.



Handling Materials in an Automobile Plant

Utilizing Elevators and Floor Openings for Carrying Material from One Floor to the Next — Continuous Assembly and Modern Devices for Facilitating Work

By FRED H. COLVIN
Editor, *American Machinist*

WHEN large quantities of material must pass through a plant each day, the method of handling it economically presents many difficult problems. And as the way in which these problems are solved has much to do with the total cost of the finished products, the methods are worth careful study from a number of different angles.

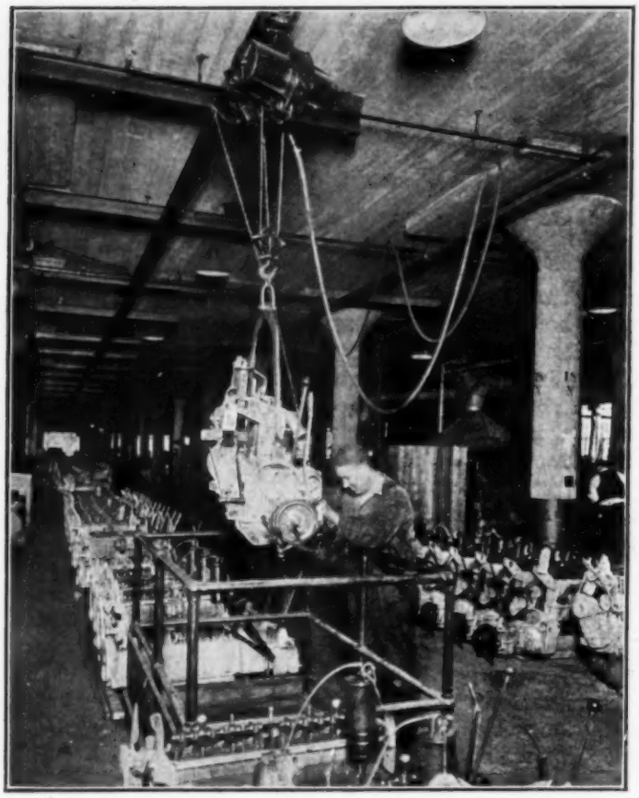


FIG. 1. LOWERING MOTORS TO ASSEMBLY FLOOR

This article shows how these problems have been met in the plant of the Cleveland Automobile Co., Cleveland, Ohio, a new plant which was designed particularly for securing automobile production in an economical manner. Fig. 1 shows one of the handling methods by which a complete motor is lowered from the third floor to the assembly line directly beneath it on the floor below.

Going now to the layout of the various floors, and beginning at the top, we have a diagram in Fig. 2 of the floor layout, each department being plainly designated. Ample aisles are provided to allow rapid and easy trucking. Some of the departments are inclosed by either a wall or woven wire partition, while others are simply separated by aisles. The size of the building is approximately 80 x 800 ft., giving about 64,000 sq.ft. floor area on each floor.

The unpainted sheet-metal parts come up to the large storage space shown and travel to the right, as indicated by the path marked with the arrow head. Those parts which require grinding and polishing are taken care of in that department, while others go straight through to the cleaning room which handles all the parts that pass through the dipping and rubbing room. They then go across the building to the long conveyor on the other side. This conveyor is continuous and passes through dip tanks and three baking ovens so that all enameled parts are automatically taken care of.

Leaving the enameling department, material comes either to the enameled parts storage, or goes direct to the elevator as shown. This layout also indicates where the hood and shell assembly takes place, as well as how pieces from the enameled parts storage are sent to the elevator for assembly on the floors below.

Parts Storage and Sub-Assemblies

The other end of the fourth floor is devoted to wheels, wheel rims and tires. Here the wheels are painted and stored to await assembly. The rims leave the rim storage department, cross the aisle into the tire storage where the tires are mounted and inflated in a suitable rack. From here they go to the wheel chute *A*, which guides them to the second floor, where they are needed for the chassis assembly.

Coming down to the third floor, the layout of which is shown in Fig. 3, we have the general storage of all parts along the upper side of the front of the building. The main units which go to make up the completed car are stored by sub-assembly operation at the nearest point of application to assembly line. The front and rear axle assembly, for example, is shown on the opposite side of the building, together with the differential and rear axle housing sub-assembly. Both of these sub-assemblies feed into the rear axle main-assembly track shown in Fig. 4.

This track takes the assembled axles to the opening in the floor at *A*, Fig. 3, where they are lowered through the opening to the second floor at the proper point for attachment to the frame. This arrangement is also shown at *A*, Fig. 4, where an axle assembly is about to be lowered to the floor beneath.

Fig. 4, also gives a good idea of the way in which the axle housing is supported on small trucks or carriages while being assembled. These trucks run on tracks at a convenient height and are very easy to handle in every way. It will also be noted that there is a return track for the trucks between the legs just above the floor, so that when an axle reaches the end of the track and is sent down to the floor below, the truck is simply placed on the lower set of rails and sent back to again take its place in the truck assembly line.

At the other end of the third floor, Fig. 3, are the brazing and welding departments and the crankcase and cylinder head storage. Between them are the crankcase sub-assembly track and the cylinder head sub-assembly. Here also are the crankshaft and connecting rod sub-assembly departments and storage, these two units meeting at *B*, and joining the crankcase sub-assembly at *C*, an overhead air hoist conveyor being used in this department. A little further along is the piston and

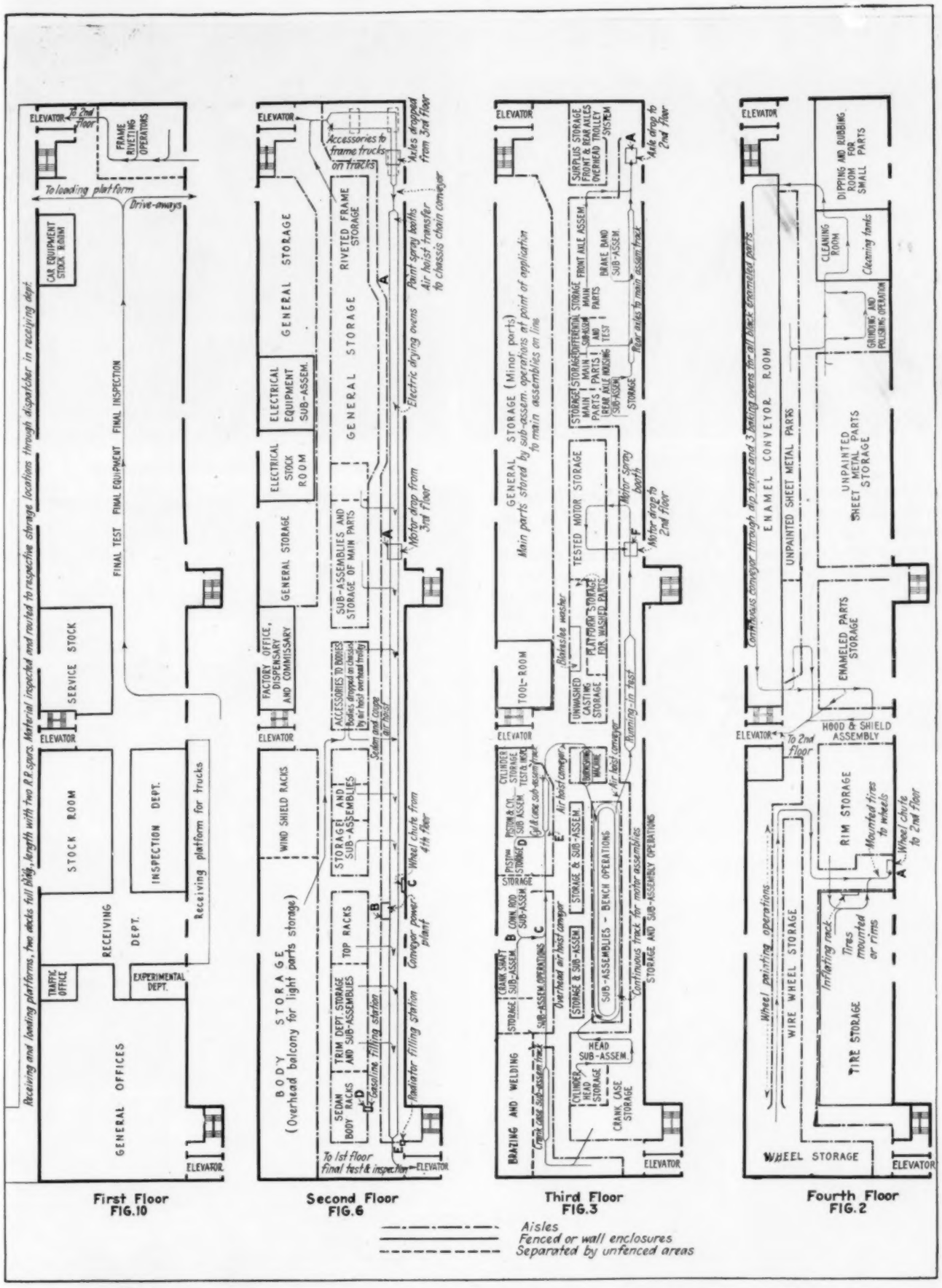


FIG. 2. LAYOUT OF FOURTH (TOP) FLOOR. FIG. 3. MOTOR AND OTHER ASSEMBLY—THIRD FLOOR. FIG. 6. LAYOUT OF CHASSIS, ASSEMBLY FLOOR. FIG. 10. FINAL INSPECTION FLOOR

FIG. 4. REAR-AXLE ASSEMBLY LINE

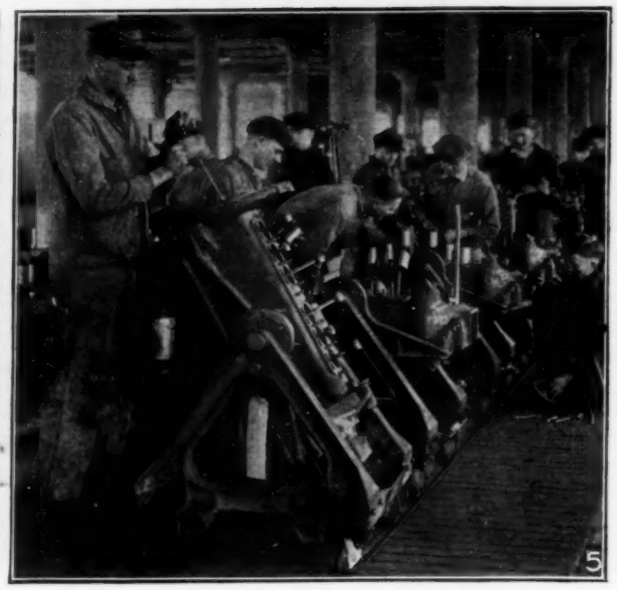


FIG. 5. MOTOR ASSEMBLY STANDS

cylinder storage, where after being tested and inspected these units join at *D*, and together go into the other assembly line at *E*.

An air hoist conveyor also takes the motors from the assembling track, where the cylinders, pistons, crankshafts, connecing rods and similar units are brought together, on to the burnishing machines, which were illustrated in a previous article. After burnishing the bearings, the motors go to the sub-assembly section shown and are there joined by the head sub-assembly. The continuous track, carrying motor assembling stands, is shown in Fig. 5. These stands it will be noted, are swung on substational trunnions and provided with an indexing pin and flange, so that the motor can be locked in any one of six different positions. The stands roll easily on the track which consists of two channels laid on top of the cement floor. Platforms on each side and in the center, bring the top of channels flush with the working platform.

After assembly, the motors go for their running test,

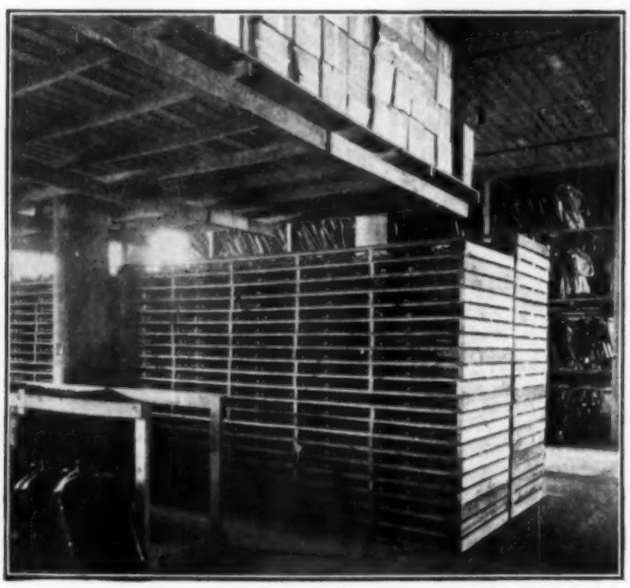


FIG. 7. STORING WIND SHIELDS AND PARTS

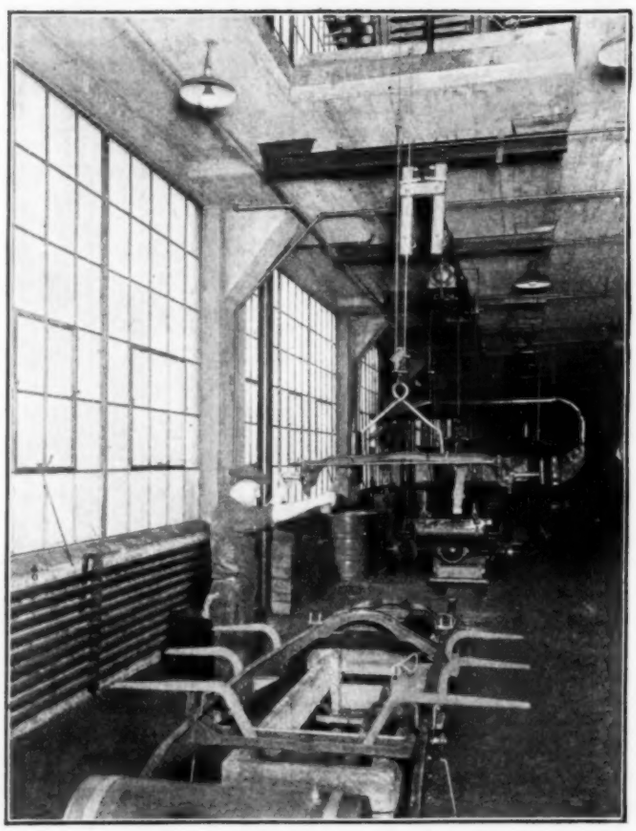


FIG. 8. ASSEMBLING AXLES TO FRAMES

after which they are sprayed in a special booth provided for the purpose. The spray removes all oil and leaves the motors clean for final assembly to the chassis. The tested motors either go into storage or direct to the opening in the floor at *F*, through which they are lowered, as shown in Fig. 1.

The second floor is shown in Fig. 6. This might almost be called the general storage and assembly floor, as it contains the frame, the electrical equipment, subassembly of minor parts, bodies and the many accessories which go to make up a completed car. A good

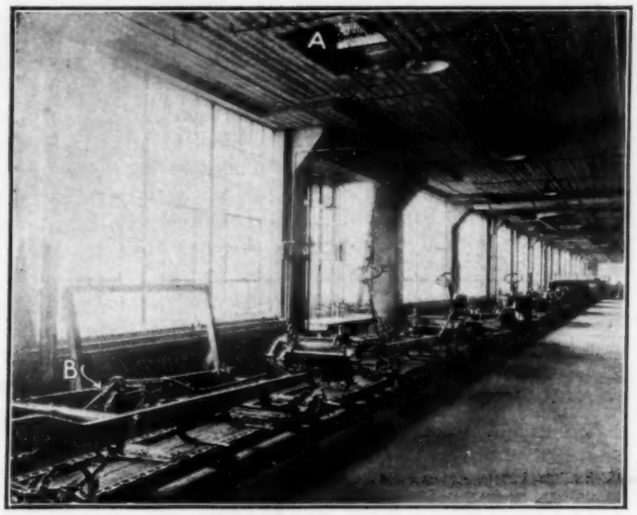


FIG. 9. CONTINUOUS ASSEMBLY TRACK

idea of some of the storage methods may be had from Fig. 7, which shows a stock of radiators and wind shields in the distance. The racks shown provide means for storing the wind shields either horizontally or vertically, and protecting them against damage while in storage. This view also shows an auxiliary storage platform which has been erected for holding light material received in cartons, and occupies considerable space. The body storage department has an overhead balcony for light parts similar to that shown in Fig. 7.

All of these departments feed material into the assembly track, the frames being carried on trucks until the rear axles have been fastened into place. The trucks support the frames as shown in Fig. 8, where a front axle assembly is being lowered into place. This assembly comes down through the opening in the floor above, shown at *A*, in Fig. 3. The rear axles are lowered through the same opening, the frame being moved forward to receive them.

Lowering Motors to Assembly Line

The motors are lowered through the opening *F*, shown in Fig. 3, and as illustrated in Fig. 1. The motors in this way reach the assembly line, the frames having been rolled over by an ingenious handling apparatus by which the air hoist picks them off the truck, allows them to be easily turned over and places them on the continuous assembling track shown in Fig. 9. This view also shows the opening in the floor above at *A*. Here the frame with axles assembled enters the spraying booth for painting and passes through the electric drying oven which sets the paint before reaching the position at *A*, Fig. 6, where the motor is lowered from the upper floor. It will also be noted that the steering gear is put in place at this point. The propeller shaft is shown at *B*, Fig. 9, ready for fastening to the transmission as soon as the motor unit is put into position.

Fig. 9 gives a good idea of the construction of the side wall of the building, the large proportion of lighting space and the small washroom provided at the side. In order to make Figs. 1 and 9 match up satisfactorily, it is necessary to note that Fig. 1 was taken with the camera pointing away from the side wall instead of toward it, as in Fig. 9. The angular top of the side wall column will, however, serve to identify them in both cases.

Sub-assembly from the stores on this floor are fed into the line as shown by the arrows in Fig. 6. An air hoist lowers the body on to the frame, body accessories are set in place and windshields, tops, etc., feed in as the frame moves along the assembly track.

Nearing the Finish

The conveyor power plant is shown at *B*, Fig. 6, while the wheel chute *C*, which was first shown in Fig. 2, ends at this floor and delivers the wheels at the proper place for assembly to the chassis. The final trimmings are added as the chassis proceeds, and at the gasoline filling station *D*, the tanks are filled ready for the motor to use in driving to the body floor.

A little further on is the radiator filling station at *E*, from which the completed car swings to the large elevator shown at the left and is lowered to the first floor for final test and inspection.

All material is received on the first floor, the layout being shown in Fig. 10. The two railroad spur tracks with two receiving and loading docks and the method of handling material is shown in Fig. 11. Here two of the electric trucks, each with its load mounted on a platform, are being handled easily and expeditiously. In

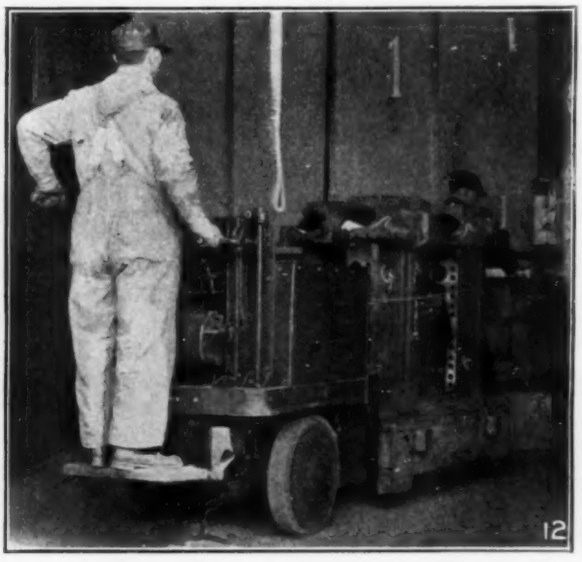


FIG. 11. RAILROAD LOADING PLATFORMS. FIG. 12. USING TRUCKS ON ELEVATORS

one case, cylinder bases are being carried to the elevator to be delivered to the motor department on the third floor. The other truck is handling rear-axle fittings directly into a box car.

After the completed car has been taken down on the elevator at *A*, Fig. 10, it is driven outside to the entrance *B*, where it follows the line marked "Final Test," "Final Equipment" and "Final Inspection." When it reaches the dividing point *C*, it swings either to the right or left, according to the method of delivery.

The back end of this floor is devoted to such frame riveting operations as are necessary, the frames going from here to the elevator which carries them to the second floor to take their place in the line, shown in Fig. 8. The layout as a whole is very complete, the entire plant being designed and arranged to secure maximum production at a minimum cost.

The elevators are large, both as to size and capacity, the load shown in Fig. 12, being run directly on to the elevator and hoisted to the third floor. These methods reduce handling cost to a minimum.

All material received is first inspected by the inspection department representative. When approved, tickets are issued by this department and sent to the dispatcher. The dispatcher marks the tickets with the number or the floor and the bay, thus routing material to its proper location to which it is handled by the electric trucks. All columns throughout the plant are numbered so as to make locations easy for all concerned in routing. The first floor also contains the general offices, the experimental department and the traffic office. It is rather interesting to note the comparatively small space devoted to the office in proportion to the productive space of the plant.

Machining Auto Starter Frames

Special Fixtures for Drilling and Tapping—Devices for Locating and Removing Work—An Unusual C-Clamp—Boring Fixture for Polepieces

By ROBERT MAWSON

THE firm of Gray & Davis, Inc., Boston, Mass., has been manufacturing generators and starting motors for automobiles for a number of years. The machining of the frame, which is used on both units, will be illustrated and described in this article. The frame, Fig. 1, is a drop forging and is shown in the rough at *A*, and finished at *B*.

The forging is first hot washed in a Niagara metal-washing machine to remove the grease and dirt. The first machining operation is done on the Gridley single-spindle automatic shown in Fig. 2. The frame is held in a large collet on the machine while the pole-shoe seat is rough and finish bored. The end is also cut to length, the rear end plate ring-fit is rough bored, while the inside and outside of commutator end and the inside of rear end plate fit, are chamfered at this setting.

The frame is then placed in a No. 4 Warner & Swasey turret lathe as shown in Fig. 3 being located on an expansion arbor. Here the front end is finish turned, the commutator end finish faced, the rear end rough and finish machined, the large hole in front end bored and reamed and the hole slightly chamfered. It will be noticed that the tools employed for machining the ring fit at the rear of the frame and the rounded portion at the forward end are both held in toolholder *A*, so that as the cross-slide is fed forward both these surfaces are machined. The finish-reaming tool for the large hole is shown at *B*. The outside diameter is then machined in the lathe shown in Fig. 4.

An Expanding Chuck

The frame is then placed on the chuck *A*, Fig. 5, being located against the pins *B*. The serrated plungers *C* are forced out against the inside of the frame not only centering it but acting as drivers as well. Two methods of operating the plungers are employed. On the lathe shown air is used, but on the Warner & Swasey lathe the standard lever arrangement furnished with the machine is utilized.

The lever used for operating the air to control the expanding arbor is shown at *A* in Fig. 4. After the frame has been located as described the outside is turned, the limit being 0.006 in. The machined surfaces are inspected with a snap gage by the operator. The frame is then ready for drilling the holes for the screw for fastening the pole-shoes and the commutator end plate. This is done in the jig shown in Fig. 6. The frame is located by a flange which fits over the rear end at *A*, and also by the reamed hole *B*. The open washer *C* is then slid over the screw as shown and the cam-shaped lever *D* is used to force the frame back to the seat and hold it securely.

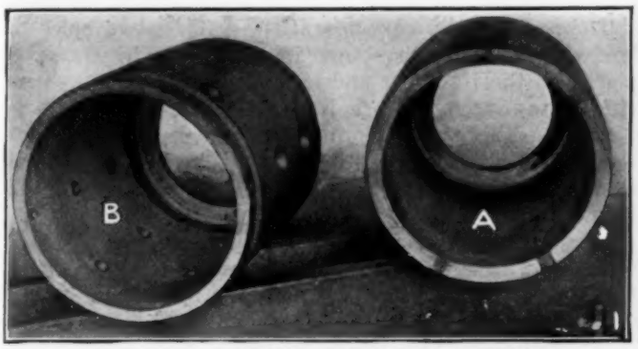
The various positions for the frame during the drilling operation are obtained by means of an index pin *E* operated by the lever. When the index pin has been withdrawn the operator turns the piece to the next position by means of the handwheel *F*. The lever is then released and the plunger locates and holds the frame in the new location.

An Unusual Jig

The frame is next placed in the jig shown in Fig. 7, being located by two pins that fit into pole-shoe holes. The four holes for screws to hold the rear end plate are then drilled.

As the construction of this jig is somewhat unusual it is shown in Fig. 8 with the frame removed. The pins *A* are used for locating the work as previously referred to, the lower end resting on and fitting over the turned lugs *B*. The lever *C* is then drawn down, operating two pinions *D* and *D* which operate racks at the rear of the square sliding plungers *E*. It will be observed that the plungers are integral with the jig cover so that as they are drawn down, the cover plate descends at the same time onto the top of the frame being drilled. The arrangement of the jig insures quick and accurate results, as the operator has an unobstructed view of the inside of the fixture when locating the piece before drawing the cover down into position. The drills are operated by means of a multiple-spindle drill head.

The next operation is drilling the four holes used to attach the nameplate, and the jig used for this work is shown in Fig. 9. The frame is slid into the jig from the front and located by means of the plunger *A*



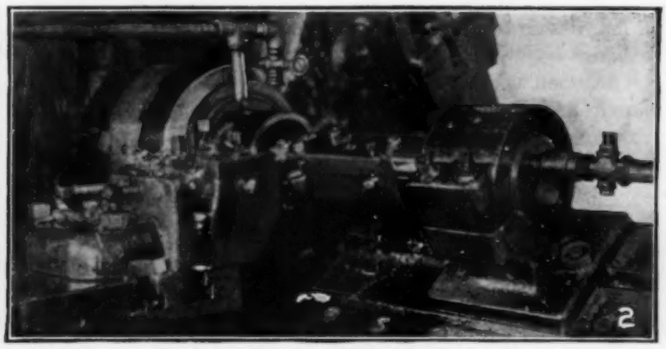
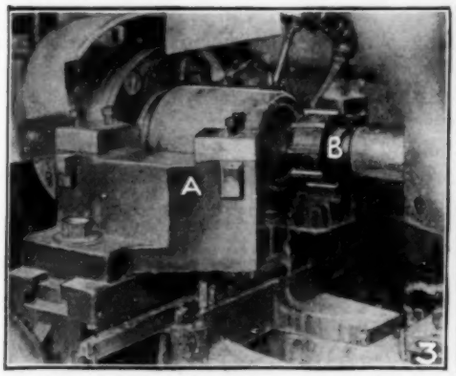
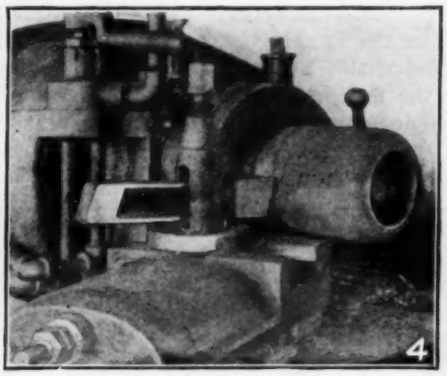


FIG. 1. THE FRAME FINISHED AND ROUGH. FIG. 2. BORING THE FRAME





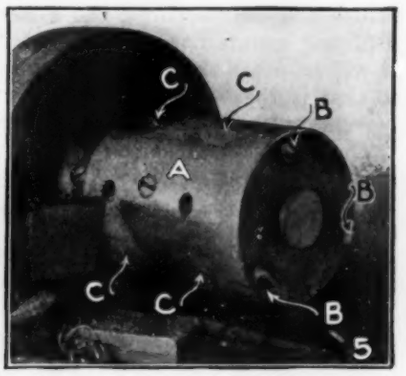
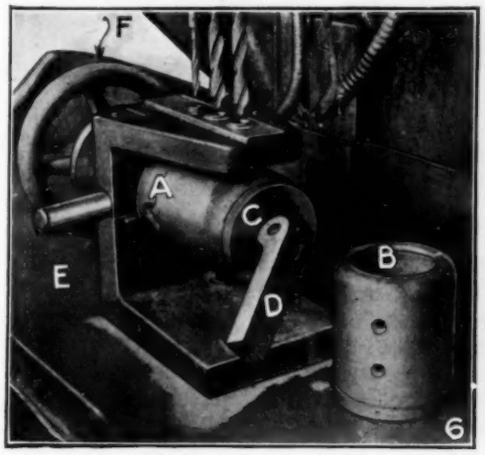
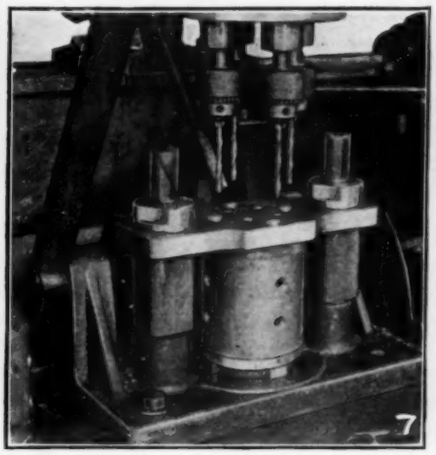


FIG. 3. REAMING THE END. FIG. 4. TURNING THE OUTSIDE. FIG. 5. THE DRIVING MANDREL





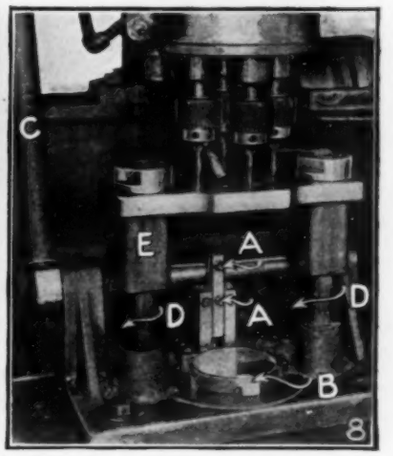
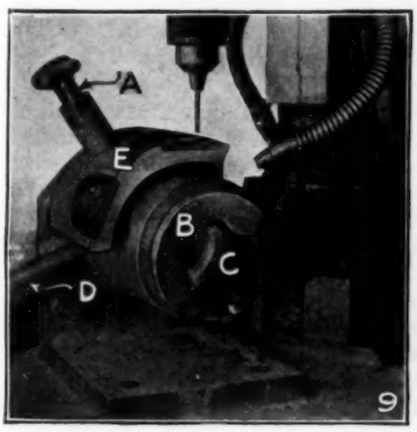
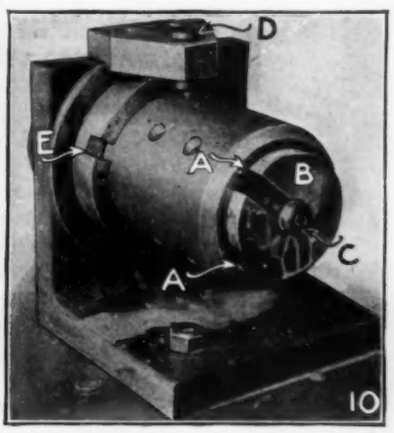


FIG. 6. JIG FOR DRILLING SIDE HOLES. FIG. 7. DRILLING THE END HOLES. FIG. 8. DETAILS OF THE JIG





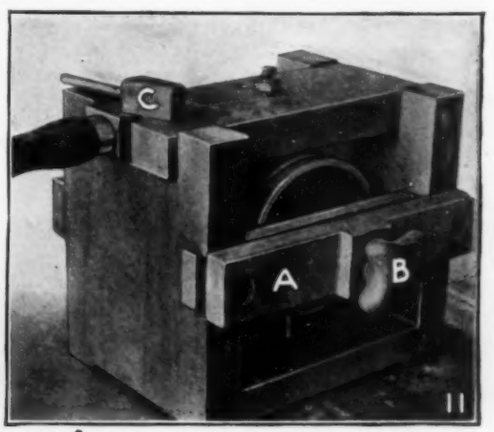


FIG. 9. ANOTHER DRILLING JIG. FIG. 10. JIG WITH "PRY" SLOT FOR REMOVING WORK.
FIG. 11. DRILLING BRACKET FASTENING

which fits into one of the pole-shoe holes previously drilled.

The open washer *B* is then placed over the screw as shown and the hand nut *C* being tightened holds the frame securely in the jig. After the first two holes are drilled, the jig arbor is turned on a center stud by means of the handle *D* to another located position and two more holes drilled, the drill being guided by bushings in the plate *E*.

The frame is then placed in a mandrel of the jig, Fig. 10, and located by two pins *A* that fit into the end plate holes. The open washer *B* is then placed under the head of the stud *C* which is drawn back by means of a handwheel at the rear of the jig. A hole is then drilled and counterbored, the shank of the combination drill and counterbore being guided by the bushing *D*. It will be noted that the jig is provided with a notch *E*, so that if the work should stick to the mandrel it can be removed easily by using a pointed tool in the notch.

The next operation is drilling two holes for the screws that fasten the bracket to the frame and the jig used for this purpose is illustrated in Fig. 11. The work is again located by two pins which fit into pole-shoe holes, the frame being placed in the jig from the top while the cover is raised. The clamp *A* is then tightened against the piece by the hand nut *B* and the cover dropped down and fastened with the screw *C* operated by the pin placed through its head.

The tool for the next operation, drilling two holes to hold the fuse clips, is shown in Fig. 12. The frame is placed on the jig arbor and located by pins in a manner similar to that in the previous jig. The C-washer *A* is next placed under the binding stud which is drawn back by a nut operated by the pin *B*. The washer is so designed as to afford a good hold for convenience in handling.

The correct positions for the two holes are obtained with a pin that projects from the revolving member of the jig and is brought alternately against stops, one of which is shown under the large flange by the lever *D*.

The frame is then drilled for the cut-out cover holes, the jig being shown in Fig. 13. The frame is placed on the mandrel *A* and located by the sliding plunger *B* which fits into the cut-out connection hole. In order to bring the frame to the correct locations for the two holes, it is revolved by the stop pin *C* which alternately strikes against stops, one of which may be seen at *D* the other being behind the frame.

The frame is then burred both inside and out and is ready for the tapping operation as shown in Fig. 14. The frame is held on the mandrel *A* and revolved to the various tapping positions. A series of small tapping machines is set up for this work so that all the holes of one size are tapped on one machine, the frame being then transferred to the next machine where the next size is tapped. By this method the taps need not be changed and better production is obtained. The four holes are tapped in the rear end of the frame by laying it on the opposite face, no special holding arbor being necessary. The frame is now given a rigid inspection and if found correct, transferred to the assembling department where the pole-shoes are placed and fastened in position.

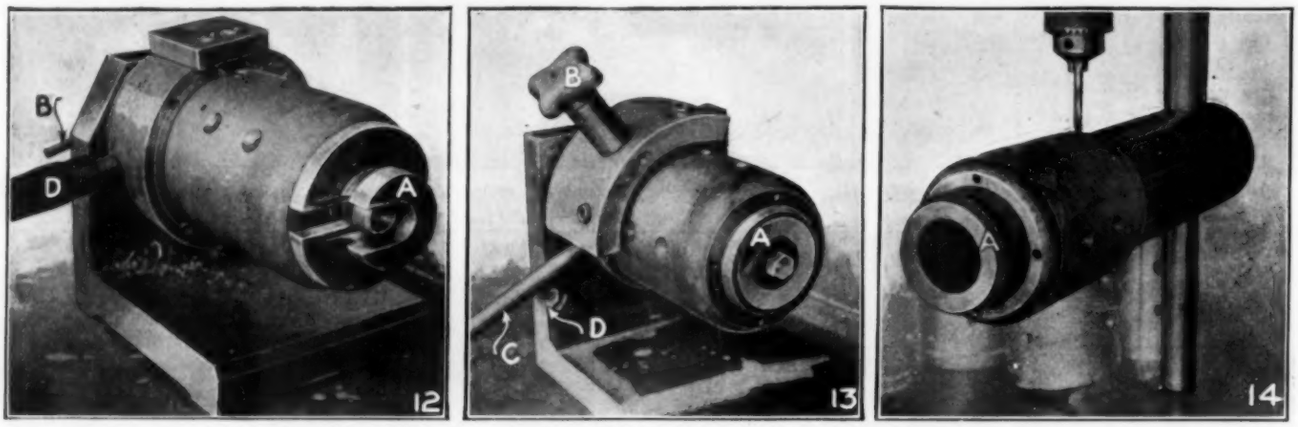


FIG. 12. AN UNUSUAL C-WASHER. FIG. 13. LOCATING SIDE HOLES. FIG. 14. TAPPING SIDE HOLES

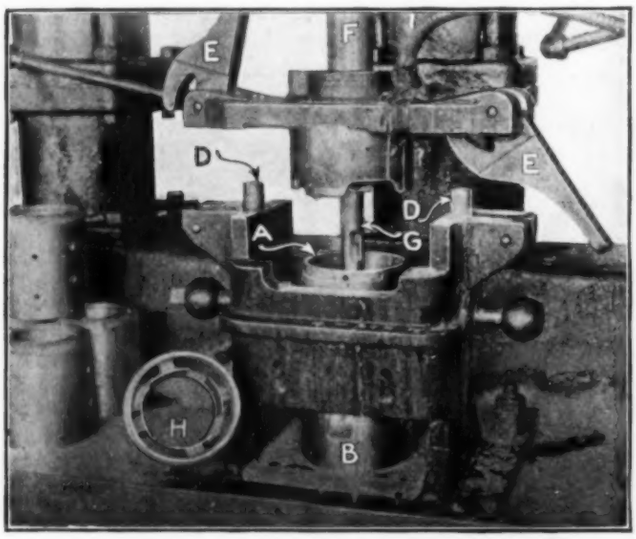
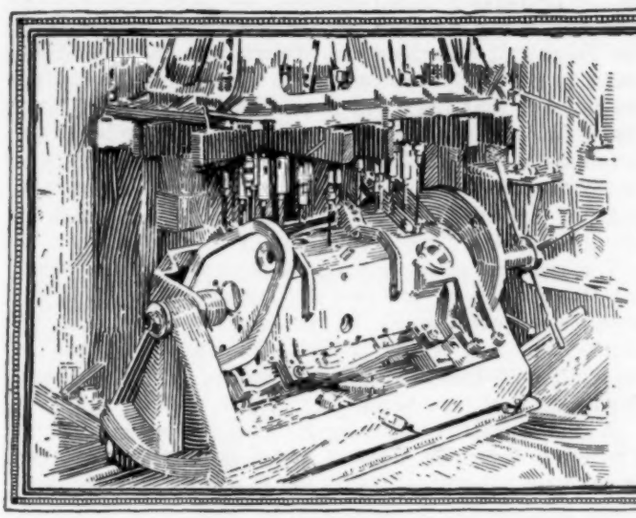


FIG. 15. BORING POLE SHOES

The fixture used in boring the pole-shoes is illustrated in Fig. 15. The frame *A* is located inside the bushing *B* which is made a good sliding fit so that it will center it correctly. The cover is then dropped down, being located by means of the large dowels *D* and held to the fixture base by two hook latches *E* which fit under the pins shown in the ears of the base.

The boring bar *F* is piloted at the top through a long bushing in the cover while the smaller portion *G* is guided by a hole in the locating bushing *B*. The notch shown in front of the bushing *B* is to enable the operator to remove the frame from the fixture if it should stick after being bored.

One of the frames with the pole-shoes bored is shown at *H*.



Tool Engineering

By
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Vise-Jaws and Vise Fixtures—Special and Swivel Jaws—Devices for Insuring Accuracy—Quick Operation—Devices for Equalizing Pressure—Automatic Ejectors

THE use of vises with plain or special jaws oftentimes makes it possible to hold small work advantageously for milling, shaping and drilling operations. Generally speaking vise-jaws are used more often for milling than for other operations. Vises can be adapted and used with special jaws to hold irregularly-shaped work which would be difficult to hold in any other way.

It is unfortunate that tool engineers do not specify the use of vises more frequently, for their advantages are so evident and their adaptability so great that they can be used profitably in many cases which would otherwise require expensive fixtures. The standard type of milling machine vise used for manufacturing in many shops is not adapted for very heavy cutting. It was designed originally for toolroom work to provide a means of holding flat and round stock for light cuts. It is theoretically wrong in principle as the thrust of the cut is taken by the movable jaw instead of by the solid jaw.

Fig. 174 shows a vise of this kind at *A*. Note that the movable jaw *B* is intentionally made long and heavy in order to make it as rigid as possible. In reality, although the vise is not designed for very heavy cutting, good results may be obtained from it and many factories use no other type. The jaw is operated by means of a screw.

The vise shown at *C* is designed especially for manufacturing. This type takes the thrust of the cut on the solid jaw *D*. The movable jaw *E* is a unit with the slide *F* on which the levers *G* and *H* are mounted. By loosening the binding lever *G* and moving both levers along in the slot of slide *F* various openings of the jaws can be easily made according to the capacity of the vise. In operation the cam lever *H* is set until the jaws grip the work firmly, after which the binding lever is tightened. As the latter is slightly eccentric to the cam lever, the locking action is improved and greater leverage obtained. Both of the vises illustrated can be furnished with special and swivel jaws.

In addition to the two types of vises shown there are special forms for toolroom use. The vise principle used is generally like that shown at *A* in Fig. 174, the difference in design being in the method of mounting the vise so that it can be swiveled in either a horizontal or vertical plane. A manufacturing vise operated by compressed air was described in a previous article.

Special vises can be made up for extraordinary conditions if it is found that standard vises cannot be used. If it is impossible to grip the work properly with special jaws in a standard vise, the designer can apply the same principles to his design and make a special vise to suit the conditions. When the capacity of a standard vise is not great enough to take in the work, a special vise can be designed providing the production required warrants the expenditure. Vises that are made up specially are apt to be costly, yet if they are to be used for high production the expense will be saved many times.

Design of Vise-Jaws

Vise-jaws are apparently very simple from the designers' standpoint, yet their importance is appreciated more as a better understanding of their adaptability and possibilities is gained. A few points of importance are given here in connection with the use of vise-jaws.

(1) Selection of vise. Most factories use several styles and sizes of vises in their production work. Data should be provided regarding the capacities of the various types in order that a selection may be made with discriminating judgment. The predominating factors which influence the selection are: (a) The depth of the jaw: (b) the maximum opening; (c) the length of the jaw.

(2) Depth of the work. As most vise-jaws are made shallow, the depth of the work to be held is an important factor in determining whether a vise can be used for a given operation or not. Within certain limits it is possible to design the jaws for a special piece of work so that they will extend above the jaws of the vise, but when this is done they should be made substantial enough to withstand the thrust of the cut and the pressure of the vise screw without vibration.

(3) Length of the work. The length of vise-jaws varies according to the type and size of machine vise selected and it is often desirable to hold a piece of work that is considerably longer than the jaw. It may also be necessary to provide some means of location beyond the end of the jaws. It should not be decided

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that a piece of work is unsuitable for holding in vise-jaws simply because the work is longer than the jaws.

(4) Vise opening. When vises are screw operated, special jaws should be so designed that very little movement of the screw is necessary to release the work, allowing it to be taken out of the jaws without

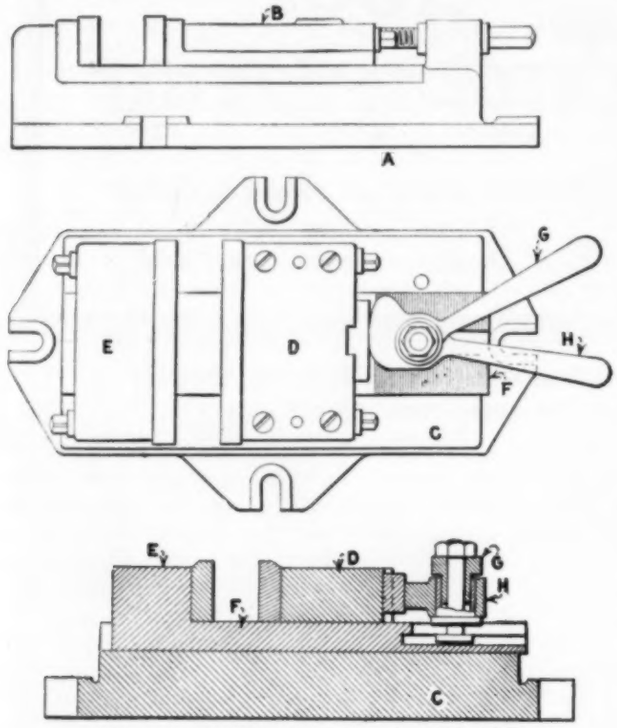


FIG. 174. EXAMPLES OF MILLING AND MANUFACTURING VISES

difficulty. In cases where the work locates on pins in one or the other of the special jaws, it is frequently necessary to provide a filler or clamping plate which can be thrown out of the way when the jaws are released in order to avoid too much movement. This matter will be taken up in detail later in this article.

(5) Formed jaws. Irregular work such as small forgings, castings and other parts which require milling operations are frequently held by means of special jaws which are "formed out" by the toolmaker to fit the contour of the work. When jaws of this kind are designed, a clamping action must be obtained on the work close to the point where the cut is to be made. For example, in a forging having a ball end, the jaw would be formed to hold the ball loosely in order to obtain the location, while the work would be gripped at other points where the cutting action is to take place. There are so many varieties of formed jaws that it has not been deemed essential to take up their design in this article. Each individual case must be treated differently according to the shape of the piece and the general requirements of the work.

General Diagram of Vise-Jaws

Fig. 175 shows a standard type of vise-jaws, such as are usually supplied with a milling machine vise. Attention is called to the fact that the dimensions *A* and *B* are fixed, according to the style and size of the vise used. It is necessary therefore to ascertain these dimensions before proceeding with the design of any special jaws. The dimension *C* is also important as it determines the maximum size of the work that can be properly gripped between the jaws of the vise.

It frequently happens that the work is higher than the height of the jaws, in which case care must be taken to see that the pressure is resisted by designing the jaws so that they will have additional support near the point where the cutting action is applied. An example of this kind is shown at *D* in which it will be noted that the jaws extend considerably above the body of the vise as shown at *E* and *F*. Support is provided by the "heel" at *G* and *H*.

The example at *K* indicates a method used for locating the work *L* on one jaw *M;* the other jaw *N* is cut away as shown at *O* to prevent trouble from an accumulation of chips. The principle used here is applicable to many kinds and shapes of small work, the location always being on one jaw only.

A good method of holding round work is shown at *P*. The work *Q* lies in a "vee" which is slightly undercut at *R* so that the pressure of the jaw *S* tends to draw it down against the surface *T* thus holding it firmly in position. This principle can be used to advantage in holding many kinds of round work.

Assuring Accuracy in Location

When work is to be milled accurately in relation to some previously finished surface it is oftentimes advisable to provide vise-jaws with an accurate means of location. This is particularly desirable when the vises used are old or more or less worn but whether this is the case or not, a very high degree of accuracy can only be obtained by making some provision in the jaws so that they will always register exactly the same. If the tolerances on the work are very close, this point must be kept in mind when designing special jaws.

Fig. 176 shows a very good method of registering vise-jaws accurately. *A* and *B* are the two jaws, one of which is provided with hardened guide pins at *C* and *D* while the other contains bushings *E* and *F*. The pins act as dowels and thus preserve the correct relation of the jaws at all times. In such a case the work might be located on suitable pins at *G*, the positions of these pins being determined by the nature of the work and the general requirements. The length of the dowel pins is determined by the thickness of the work and the method of location. The side view of the jaw gives a clear idea of the relative positions of the screw holes *H* and *K* and the dowel pins mentioned.

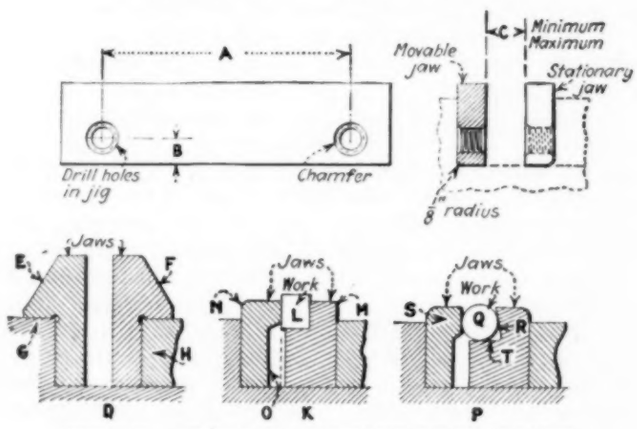


FIG. 175. GENERAL DIAGRAMS OF VISE-JAWS

Two other methods are shown in the same illustration. In one of these the work *M* rests on the shoulder of a special jaw *O* while it is gripped by the other

jaw *N*. A support is provided at *P* which acts in a somewhat similar manner to the dowels previously mentioned by preventing the movable jaw from lifting when it is tightened. These jaws would be improved by giving them a shoulder at *Q* and *R* similar to the case shown previously. One objection to this design is that the spaces at *T* and *S* are narrow and therefore they form an excellent place for chips to accumulate and cause trouble in closing the vise.

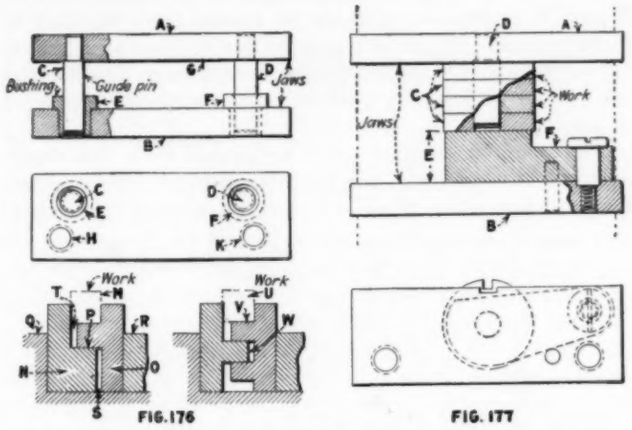


FIG. 176. ASSURING ACCURACY IN LOCATION

FIG. 177. PROVISION FOR QUICK REMOVAL OF WORK

Another example of an *attempt* to provide an accurate means of location is shown in the jaws holding the work *U* in Fig. 176. In this case the work rests on the shoulder *V* and a tongue is provided at *W* which is intended to prevent the jaw from lifting and thus obtain greater accuracy than would be otherwise possible. The objection to this type is that it is more or less expensive; there are bad pockets for chips and it is generally impractical.

In analyzing the methods of location shown in this illustration it is obvious that the guide pin method is the best on account of its adaptability, simplicity in construction, and the ease with which the jaws can be cleaned. The cost of construction and the accuracy obtained are additional points in its favor.

Quick Removal of Work

When making up a set of vise-jaws it must be remembered that the rapidity with which the vise is operated is dependent to a great extent on the amount of opening necessary to remove and replace the work. When the latter is of such a nature that it must be located on a stud and removed from the stud after the operation, a considerable opening to the jaws may be required. When a cam operated vise is used a certain amount of opening can be made rapidly and this may be serve to take care of many conditions, but when the regular type of milling machine vise is used, every half revolution of the screw means that the operator is obliged to remove his wrench and replace it again. This takes time and is a decided objection if the jaws need to be opened rapidly. In order to obviate this trouble it is customary to provide a filler block to lie between the work and one jaw. By taking out this filler block the work can be removed and replaced readily and not more than a half turn of the screw is required to provide sufficient opening. The filler can be made in the form of a loose piece or it can be pivoted to one jaw so that it can be swung out of the way when not in use.

Fig. 177 shows a pair of jaws at *A* and *B*, the jaw *A* holding four collars *C* by means of the locating block *D*. If no provision were made for rapid removal of the work it would be necessary to open the jaws the distance shown at *E* in order to allow all four collars to be removed at once. To provide against such a contingency, the jaw *B* is provided with a swinging block *F* which acts as a clamp against the work and yet is quickly removable. The designer is advised to make provision of this kind in all cases where similar work is to be handled. Although it is permissible to use a loose piece for the same purpose, it is not nearly as good as a swinging member.

Swivel, Multiple and Floating Jaws

When rough work is being held by being gripped on two or more surfaces, it is advisable to provide a swivel jaw in order to hold it properly. Also when several pieces are being held at the same time there is a possibility of slight variations in thickness or diameter of these pieces which makes it necessary to provide some means of distributing and equalizing the pressure.

Fig. 178 shows a piece of work at *A*, being held for a milling operation. The lugs at *B* and *C* are likely to vary somewhat in height, therefore provision must be made for this by means of a swivel jaw as shown at *D*.

An example of a swivel jaw arranged so that it will hold four pieces is shown at *E*. In this case the work consists of four bars *F*, located in the V-block jaw *G*. The other jaw *H* is made in the form of a swivel block having two supplementary swivels at *K* and *L*.

The designer should remember that all of the pressure of the jaws will come upon the pins at *M*, *N* and *O* if made like the illustration. It would be much better practice to make the pins mentioned a loose fit in the swivel and let the pressure come against the radius at the back of each of the blocks. The pins should only act as retainers and not take any pressure.

A supplementary or floating jaw is sometimes used to hold several pieces, as shown at *P*. This method is useful where several pieces are to be milled at one time. The block lies between the two jaws *O* and *R* and is located by means of a pin in an elongated slot shown at *S*. In operation, the work is loaded by removing the floating jaw *P* and placing the piece on it after which it is set in position between the jaws and clamped in place. This method is useful for handling small pieces of work when a number of them are to be located at one time. If there is likely to be a variation in the length of the pieces, the jaw *Q* can be made in swivel form to take care of the variations.

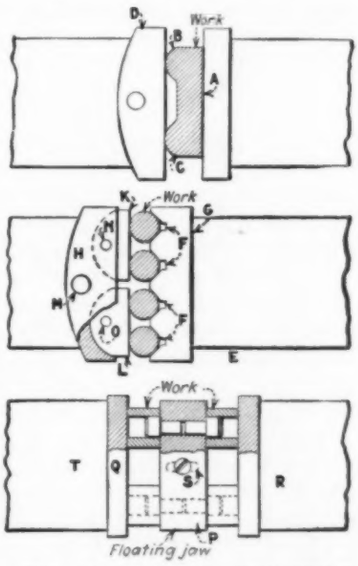


FIG. 178. SWIVEL, MULTIPLE AND FLOATING JAWS

It is sometimes possible to use the same set of jaws for more than one operation on the same piece of work.

and when this can be done without interfering with the production schedule it is obviously an advantage. Occasionally jaws can be provided with two sets of

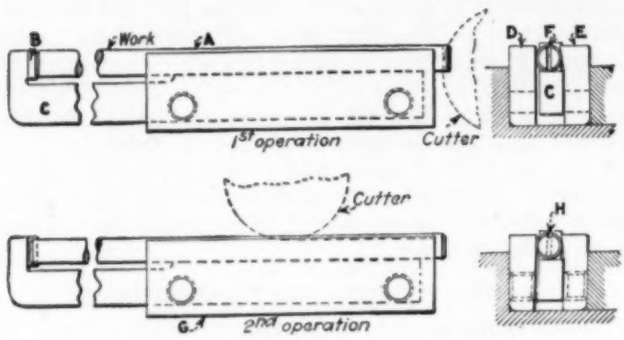


FIG. 179. METHOD OF LOCATING AND HOLDING LONG WORK

pins or other means of location and cutters can be arranged on the arbor so that both operations can be done at the same time; one piece being finished while the other is being rough-milled. When bar work is to be milled it is often possible to use the same jaws for several operations. An example of this is shown in Fig. 179, in which the work *A* is a bar somewhat longer than the jaws in which it is being held. The bar is located endwise by the stop at *B*, this stop being a part of the extension *C* which is fastened to one jaw. An end view of the jaws is shown at *D* and *E*, where it will be seen that the jaw *E* is slightly undercut to assist in holding the work. The locating bar *C* is fastened to the jaw *E* and acts as a support for the work as indicated.

The first operation consists in cutting a slot in the end of the bar at *F*. The locater *B* is made so that it will fit this slot, therefore not only can the work be set up for the second operation with the same set of jaws, but the second operation will be properly located in relation to the first. The second operation consists of milling a longitudinal slot in the bar as shown at *H*.

In locating small work in vise-jaws a great deal

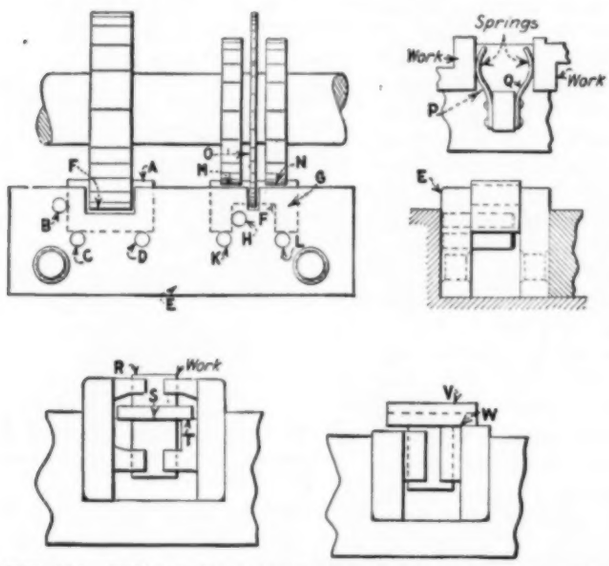


FIG. 180. EXAMPLES SHOWING METHODS OF LOCATION

depends upon the shape of the piece Fig. 180 shows an excellent example of a production job on a small piece of work on which two operations are being performed at the same time. The work *A* is located on pins at *B*, *C* and *D* in the jaw *E* while the slot is cut at *F*. This is the first operation on the work after it has been cut off. In the same set of jaws the piece is held in another position as shown at *G* and located by the milled slot *F*, using locating pins at *H*, *K* and *L*. This operation mills the slots at *M* and *N* and also cuts the work into two pieces by means of the slotting cutter *O*. As it is possible that the work might not be located firmly against the two pins at *B* and *H*, provision is made to insure their contact at these points. By using a pair of flat springs at *P* and *Q* the work will be automatically forced over against the locating pins without particular attention on the part of the operator.

The work shown at *R* must be located from the shoulder *S*. This brings up a point in design which is frequently neglected when vise-jaws are made and that

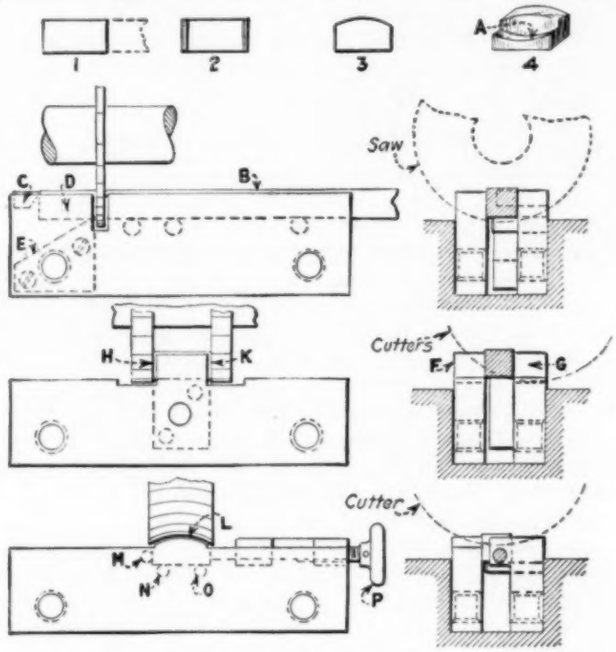


FIG. 181. VISE-JAW DESIGN FOR SEVERAL CONSECUTIVE OPERATIONS

is the alignment of the jaws. It is always advisable to make the shoulder location on one jaw only as shown at *T*, rather than to attempt to line up two shoulders on opposite jaws. Another example of a shoulder location is shown at *V*, in which case it will also be noted that the location is on one jaw only. There are occasional cases when this rule can be overlooked, for example, when dowel pins are used in the jaws to insure accuracy as shown in Fig. 176. However, it is safer to follow the rule of locating on one jaw only.

Vise-jaws Designed for Several Consecutive Operations

It is interesting to note the adaptability of vise-jaws for holding small parts which have several consecutive milling operations. An example which illustrates this point is shown in Fig. 181. The consecutive operations are shown on the rectangular block in the illustrations 1, 2, 3, and 4. The work is first cut off from a rectangular bar so that it takes the form 1. The next operation is the forming of the radius shown at 3, and the fourth operation is the profiling of the circular cut shown at 4-*A*. In the first operation the bar *B* is

placed in the jaws shown until it strikes the end stop *C*. The jaws are then tightened and the portion *D* is cut off. When the jaws are loosened the piece slides down

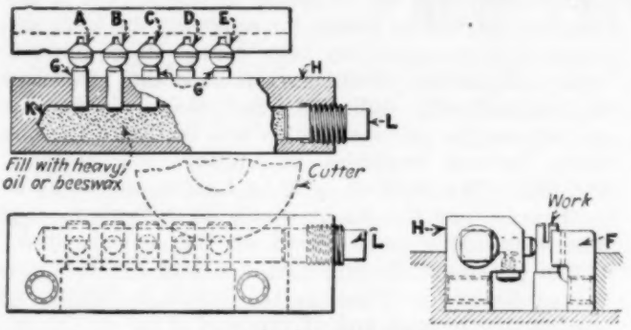


FIG. 182. EQUALIZING PRESSURE BY MEANS OF BEES-WAX JAWS

the inclined plane *E* into a box provided for it and the bar *B* is pushed forward again until it strikes the stop *C*, after which the cutting-off operation is repeated.

In the next operation the work is held by means of the jaws *F* and *G* while the straddle milling cut is made at *H* and *K*. This operation machines the piece to length, a suitable allowance having been made for this operation while cutting off the work.

The next operation is the cutting of the radius as shown at *L*. The work is held by suitably formed jaws and is located against the pins *M*, *N* and *O* by means of the thumbscrew *P*, which is so placed that it is outside of the milling machine vise and can therefore be easily manipulated. These three examples have been given to familiarize the designer with the methods used for progressive operations on small parts. Many applications can be made of the principles shown here.

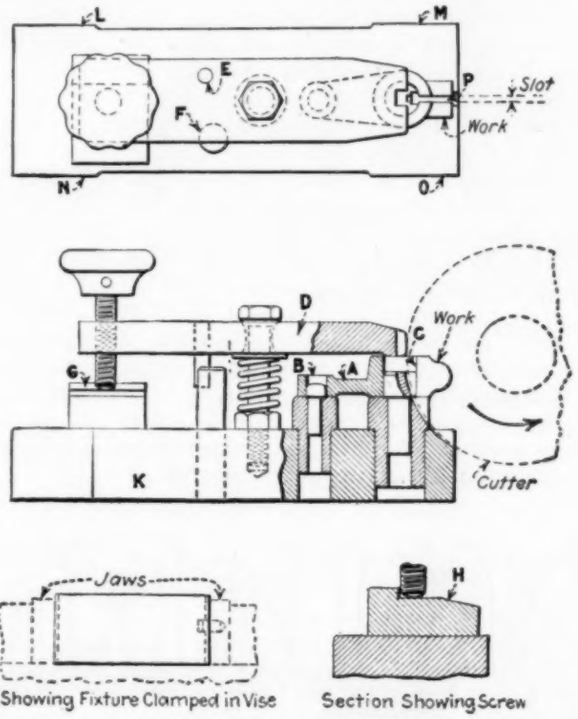
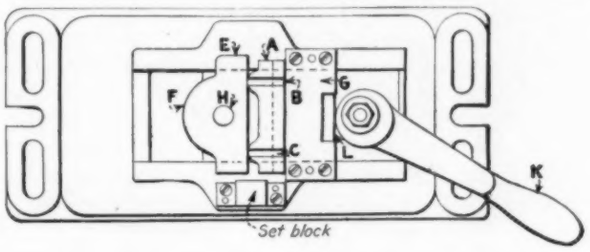


FIG. 183. VISE FIXTURE TO HOLD SMALL WORK

There are instances when a number of pieces are to be held at the same time in a set of vise-jaws and yet it is difficult to make sure that all of the pieces are held firmly, due to slight variations in the work. There are also irregular forms which have to be supported at several points while cutting, and which must incorporate some method of equalizing the supports to take care of slight inaccuracies in the work. The principle shown in Fig. 182 can be applied to a variety of conditions, and it has been used successfully for holding work which would be difficult to support by any other known method. In the example shown there are five parts *A*, *B*, *C*, *D* and *E*, located in V-blocks in the jaw *F*. The other jaw is equipped with a series of plungers *G* which are lapped to an accurate sliding fit in the jaw *H*. The chamber *K* in this jaw is filled with bees-wax or heavy grease. When this mass is compressed by means of the screw at *L* the vise pins *G* are forced out until they all come in contact with the work. After the first adjustment has been made by means of the screw the pins will automatically



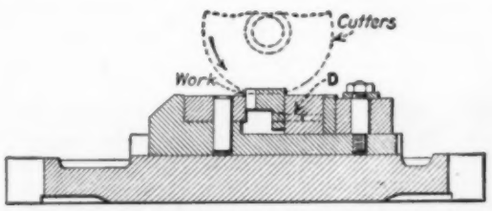


FIG. 184. SPECIAL VISE WITH EQUALIZING JAW

equalize themselves so that a positive contact will be assured on each one. In making up a set of jaws of this sort care must be taken that the various fits for the pins and the screw are carefully made in order to prevent leaks when the pressure is applied.

Vise Fixture for Small Work

Occasionally a milling operation has to be performed on a piece of work which is difficult to locate in vise-jaws. When a condition of this kind arises it is sometimes possible to design a vise fixture in which the work can be located and clamped and then the fixture itself placed between the vise-jaws for the milling operation. A case in point is shown at *A* in Fig. 183. This piece of work has previously been drilled and reamed at *B* and *C* and faced on both sides. It is located on two pins in the holes and clamped by means of the strap clamp *D*. This clamp is so arranged that it swings away from the work until the pin *E* strikes the stop pin *F* in the body of the fixture, thus permitting the work to be removed. When the work is clamped the point of the screw *G* rides up on the angular surface of the block *H* and a wedging action takes place which makes the operation very rapid. The fixture *K* locates between the jaws of a standard vise which clamps it at the points *l*, *m*, *n* and *o*. Provision is made at some convenient point so that end location in the vise-jaws will be assured. The operation to be done in this fixture is the cutting of the slot at *P*. Obviously this method

of holding is convenient and at the same time the fixture is cheap and can be operated rapidly. Cases are found now and then when a fixture of this kind can be used to advantage.

Special Vises with Equalizing Jaws

As a vise of suitable dimensions to handle the work *A* shown in Fig. 184 could not be obtained, a special vise was designed. The work is located by means of two

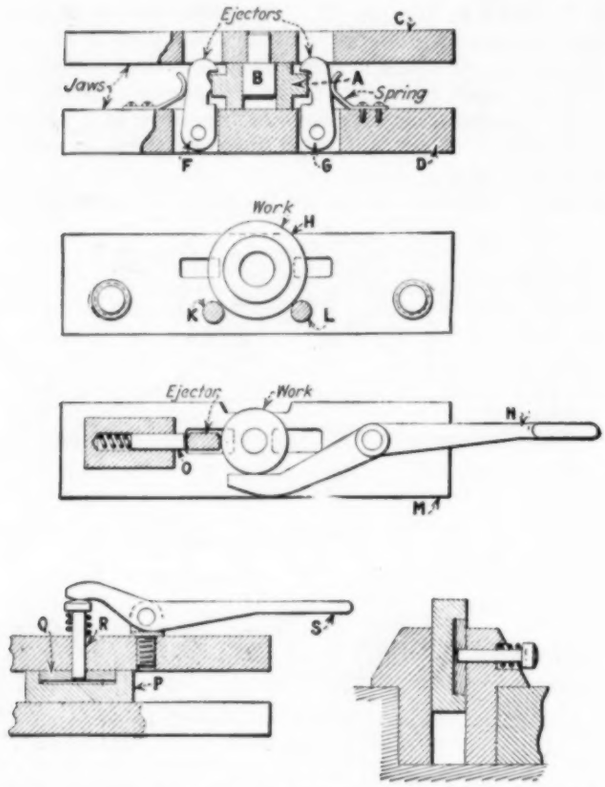


FIG. 185. VARIOUS TYPES OF EJECTORS FOR VISE JAWS

pins at *D* in the solid member of the vise. The work to be done is the cutting of the two slots *B* and *C*.

The swivel block *E* fits the radius at *F* in the sliding member which passes under the rigid block *G*. The pin *H* acts as a retainer only and is a free fit in the hole. In operation the cam lever *K* acts against the hardened block *L*, clamping the work firmly. The body of this vise is made of cast iron and the sliding parts are all carefully fitted to insure the necessary accuracy. It will be noted that construction of this vise is such that the cutting action comes against the solid member and not against the movable jaw.

There are occasional cases when special vises can be made up to suit a particular condition but unless the conditions are such that the expense of a special vise is warranted, it is better to use a standard vise.

As a refinement in the design of vise-jaws it is often necessary to provide means for removing the work after the milling operation has been done. Many times the shape and position of the work is such that it can only be removed with difficulty. For cases of this kind ejectors can be provided which will facilitate the operation. Several examples of ejectors are shown in Fig. 185. The work *A* is to be located on the stud *B* in the vise-jaw *C*. As it would be difficult to locate this work easily it is placed on the movable jaw *D* so that it rests on the two pins at *K* and *L*, which locate it approximately. Then, as the jaw is moved up into position the beveled end of the stud *B* enters the hole, thus locating the work correctly. After the work has been done, the ejectors *F* and *G* pull the work away from the stud, making it easy for the operator to remove it. This method precludes the necessity of using a screwdriver to pry the piece off from the stud, which might result in damage to the work or springing the stud out of alignment.

The form of ejector shown at *M* can be used either by itself or in connection with a piece of work like that at *A*. Assuming that this work is the same as the other piece except that it is smaller and thinner, it would be difficult for the workman to get his fingers into position to remove the work. Ejectors similar to those shown at *F* and *G* could be used here to pull the work off from the locating stud, but after it had been removed it would still lie in the jaw in such a position that the workman could not get hold of it easily. By making use of the lever *N*, however, the piece could be raised so that it would be easily accessible.

Attention is called to the construction of the plungers *O* which provide the spring pressure for the ejector. This method is entirely different from the other and it has some advantages, although it is a little more expensive in construction. There is no danger of this type of spring plunger being clogged up with chips or dirt.

The work *P* is located on a button at *Q* and it will be seen that such a piece might be difficult to remove after it had been machined. Using the lever *S* to operate the plunger *R* makes the operation much easier and the work can be removed without difficulty.

In the design of vise-jaws, particularly when small and thin pieces are to be handled, the ejector is an important factor as it assists greatly in cutting down the operating time. In addition to this, the work can be removed readily and without injury and as there is no necessity for hammering or otherwise injuring the fixture, a better product is assured.

Shop Work on Locomotive Cylinder and Valve Parts

Finishing Saddles of Cylinder Castings—Radial Planing Attachment for Saddles—Portable Cylinder Boring Device—Heating Cylinders for Welding—Machining Air Pumps

By J. V. HUNTER

SOME locomotive shops do not make a practice of finishing the saddles of cylinder castings, they simply mount them in the rough state. Others strike the arc of the boiler shell on the edge of the saddle flange and make some pretense of chipping away

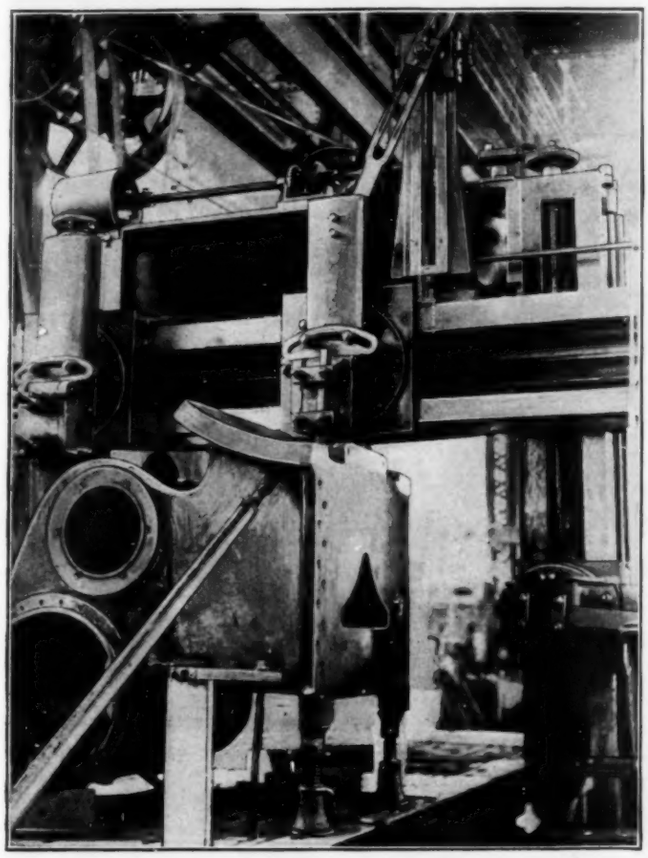


FIG. 1. PLANING A SADDLE TO FIT THE BOILER RADIUS

by hand any high spots that show up too badly. A more careful practice is followed in the Decatur shops of the Wabash Railway Co., where the arc is laid out and the surface of the casting is planed to a finish with the correct radius. It is claimed that this practice gives better results in mounting and the cylinders are more readily interchanged, giving greater assurance of a good fit when replacements are made.

Planing the saddle is done on the large Niles planer shown in Fig. 1. The casting is levelled into position by heavy jacks and a variety of clamps and braces are used to hold the piece in place. The radius planing attachment, built in the shop, is easy of adjustment and accomplishes the work in an efficient manner. It is shown in greater detail in Fig. 2. The toolhead *A* is standard and no changes have been made in it except to remove the vertical feed-screw from the toolslide, leaving it free to be pulled up or down on the slide, which has been fixed in a vertical position on its saddle.

The cast-iron bracket *B* is bolted on the top of the crossrail, and this together with its related parts provides for the adjustment of the depth of the cut and for swinging the tool at the required radius. The radius yoke *C* has a pivoted bearing on the inside of the toolslide at *D*, and another bearing at the pivot *E*. The first pivot is fixed in position; the second permits adjustment of the length of the yoke, which is accomplished by releasing clamping bolts and then sliding the yoke up or down until the desired length is obtained. The length of the yoke fixes the radius that will be planed, or in other words, the distance between the centers of the two pivots is equal to the radius that will be planed by the tool. Therefore one side of the yoke has been graduated in inches so that the operator can more easily set up the device for planing to the required size.

The pivot *E* is carried on the slide of a saddle that can be moved up or down the bracket *B* by means of the feed-screw *F*, which is hand-operated by a wheel on the end of the crossrail that acts through the shaft *G* and the set of spiral gears *H*. When the yoke is

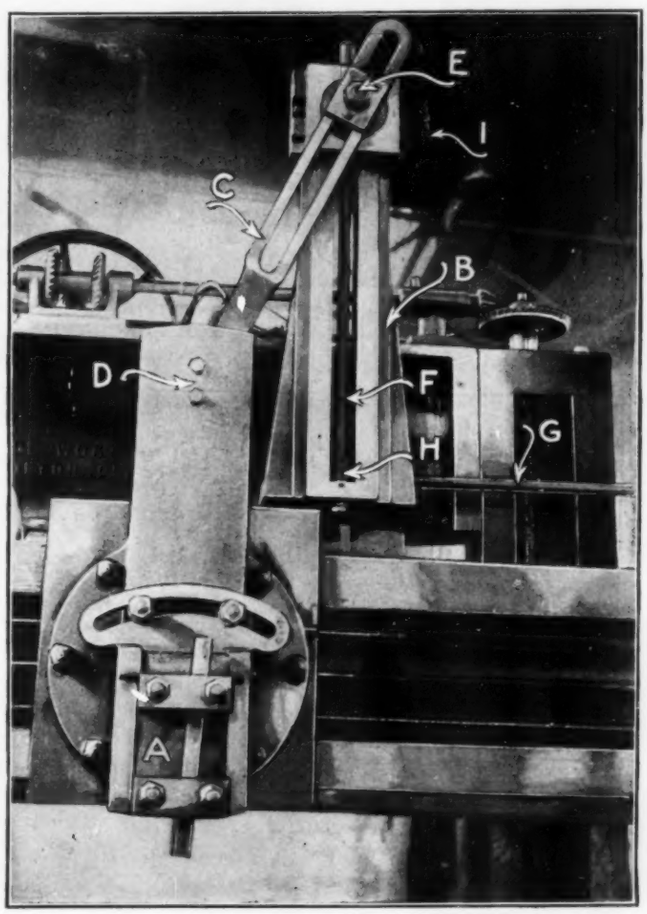


FIG. 2. RADIUS PLANING ATTACHMENT FOR A LARGE PLANER

clamped to the pivot *E* the movement of the pivot up or down on its bracket carries the toolslide with it and thus adjusts the tool for depth of cut. The slide with the pivot *E* can be adjusted horizontally on its saddle by means of a feed screw operated by the handle *I*,

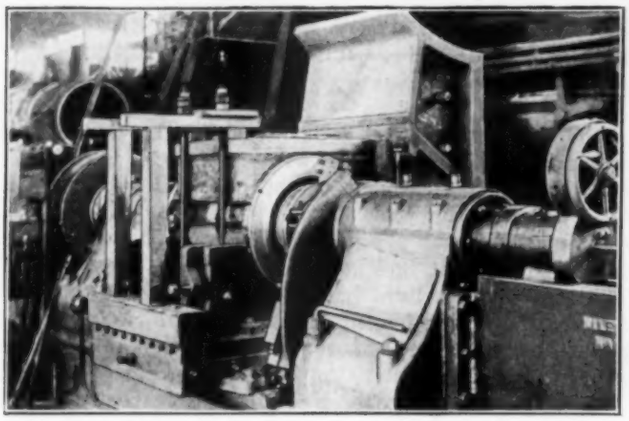


FIG. 3. BORING CYLINDER CASTING ON A NILES HORIZONTAL BORING MILL.

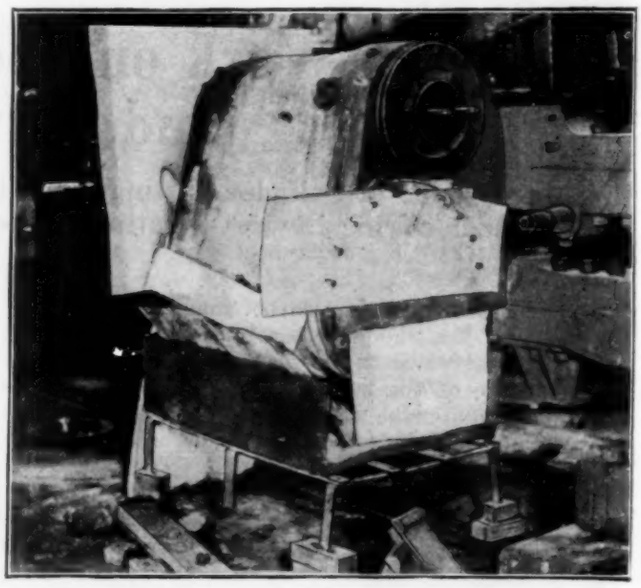
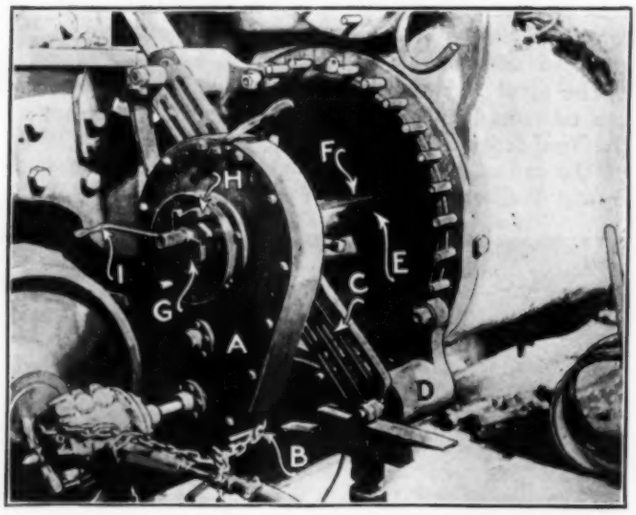


FIG. 6. PRE-HEATING CYLINDER BEFORE WELDING CRACKED SECTION



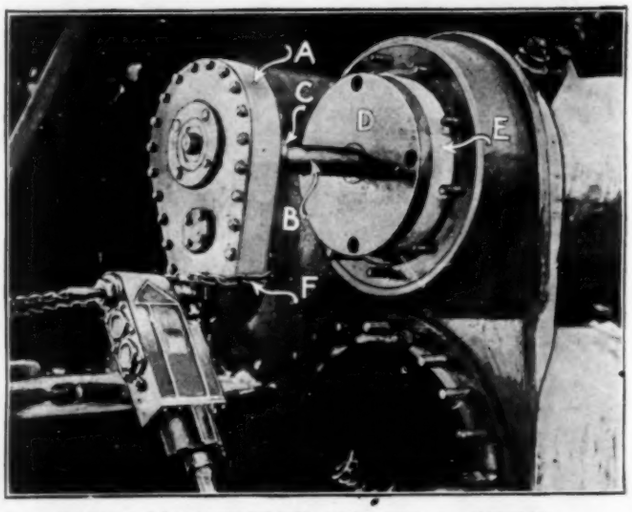


FIG. 4. REBORING CYLINDERS WITHOUT DISMOUNTING FROM LOCOMOTIVE FRAME.

FIG. 7. DEVICE FOR FORCING-IN PISTON VALVE BUSHINGS

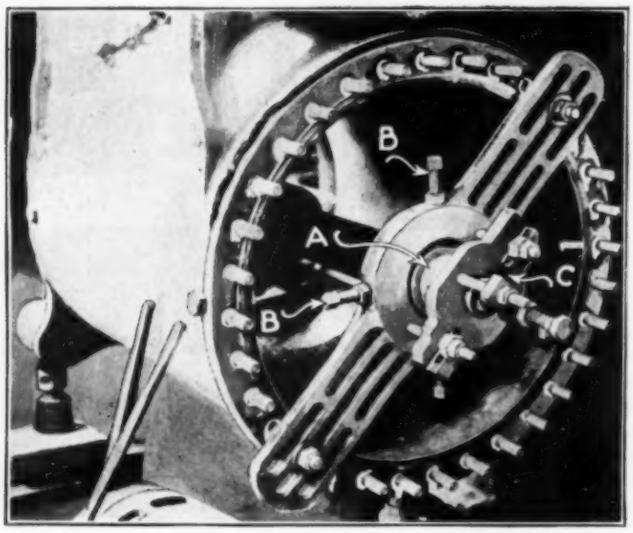


FIG. 5. DEAD END OF CYLINDER BORING BAR.

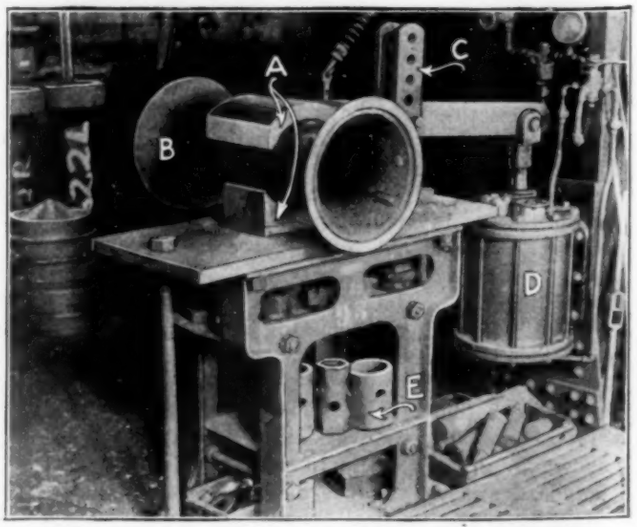


FIG. 9. CLAMPING DEVICE FOR HOLDING PISTON VALVES

thus permitting the pivot to be set so that it will stand plumb over the center plane of the cylinder saddle.

When the attachment has once been set for the proper radius and adjusted for depth of cut, all subsequent movement of the tool is accomplished by feeding the toolhead along the crossrail. In this case the cut progresses from right to left, starting the cut on the vertical center plane of the saddle. As the toolhead moves toward the left the yoke pivots at *E* and swings its outer end upward thus causing it to travel in the arc of the desired circle and the tool at the same time moves upward, thus keeping each successive cut on the same radius.

Boring New Cylinders

Boring operations on new cylinder castings are handled on the Niles boring mill shown in Fig. 3. The mill is equipped with opposed spindles so that the flanges on both ends can be faced off after the boring operation has been completed. The usual type of cylinder facing tool is used, this being carried in a swinging arm which is provided with a star feed.

Re-boring of worn cylinders is accomplished without removing the cylinders from the engine frame, by means of the portable tool shown in Fig. 4. This device was built in the shop and like many other portable power-driven tools found in railroad shops, it has a pneumatic motor for its power unit. The motor in this case is connected with a spindle at the lower end of the gear case *A*, and drives the boring bar through a gear reduction. The gear case hangs from the boring bar and is prevented from rotating by the chain *B* that is drawn around some portion of the front truck. The driving end of the boring bar is supported by the slotted bar *C*, bolted to the brackets *D* that are in turn held by the stud bolts in the end of the cylinder. Centering the boring bar is not accomplished by shifting the bar *C*, but by special adjusting setscrews fixed in a ring in the center of the bar. This form of adjustment is clearly shown in the view of the dead end of the boring bar, Fig. 5. The boring bar rotates in a bearing collar *A* that can be adjusted for centering the bar by means of the four setscrews *B*. The clamp *C* is bolted to the slotted crossbar and carries an adjustable center that serves to take the thrust of the boring bar and steadies it against end play. A single arm on the boring bar carries the tool and it is fed by means of the feed screw *F*, Fig. 4, that lies in a groove along one side of the bar. The feedscrew is operated by the star wheel *G* which comes in contact with the stationary pin *H* at each revolution of the boring bar. The handle *I* is provided for rotating the feed screw by hand when setting up work or for returning the tool arm to the starting position for taking a second cut. A screw adjustment is provided on the tool arm for setting the tool bit for depth of cut.

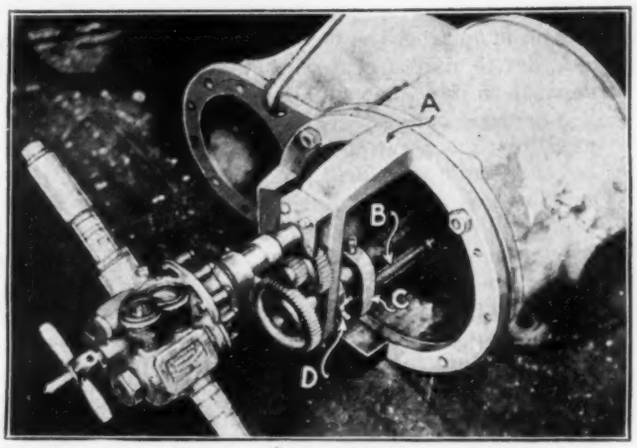


FIG. 10. PORTABLE TOOL FOR RE-BORING AIR PUMP CYLINDERS

Torch welding is frequently done on cylinders without going to the trouble and expense of removing them from the frame. A cylinder prepared for the preheating that must be done for a job of this kind is shown in Fig. 6. The preparatory work consists of arranging a charcoal fire so as to bring the casting slowly to a temperature at which the welding operation can be performed without danger of subsequent damage due to shrinkage cracks when the welded section cools. The asbestos lagging was only removed from the cracked section and from the bottom of the casting, so that it might more readily absorb heat at this point while the upper section of the lagging prevented radiation. All other portions of the cylinder were covered with asbestos sheets so as to retain as much heat as possible. Occasionally a charcoal fire can be built inside the cylinder, but better practice employs the fire basket that may be seen below the cylinder in the illustration. The fire basket was very simply made from a section of smoke box cinder-screen, and a light frame is used

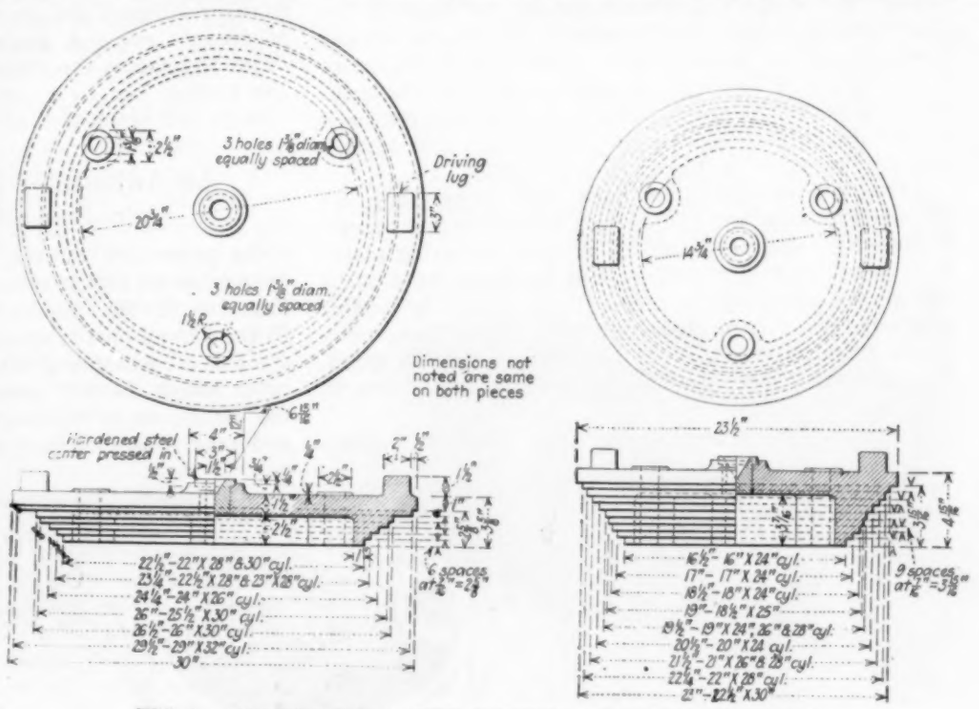

3 holes 1⅜" diam. equally spaced
Driving lug
3 holes 1⅜" diam. equally spaced
Dimensions not noted are same on both pieces
Hardened steel center pressed in
6 spaces at 2⅝" = 15¾"
9 spaces at 2⅞" = 25⅞"

FIG. 8. CENTERS FOR LATHE-TURNING CYLINDER BUSHINGS

to hold it up from the floor and near to the work above.

A device used for forcing in or pulling out piston valve bushings, shown in Fig. 7, facilitates this work and replaces a heavy screw and nut that was formerly used for this operation. Power is furnished by a standard air motor, its drill socket fitting over a tapered spindle end on a projecting portion of the shaft to which the first pinion gear is keyed. The gear housing *A* contains a train of gears giving two reductions before the power is imparted to the screw-shaft *B*. The shaft has a bushing *C* against which the flange *D* bears while it is forcing the bushing *E* into place.

Across the further end of the valve chamber is bolted a heavy bracket that supports the nut in which the screw shaft operates and takes up the thrust that is created while pulling a bushing into place. The bushings are given a heavy coating of white lead on their outside surface, which acts both as a lubricant while

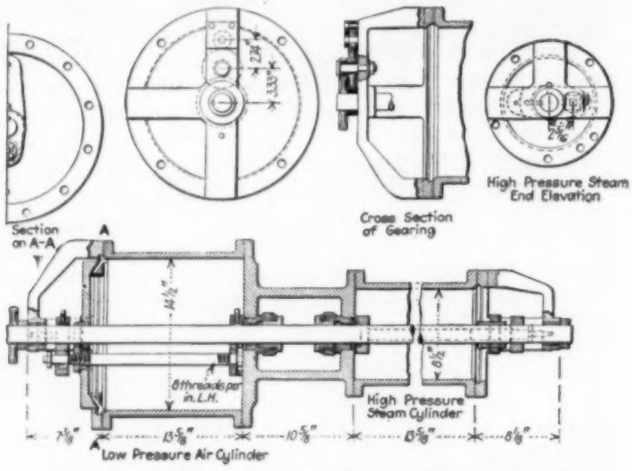

Section on A-A
Cross Section of Gearing
High Pressure Steam End Elevation
8 threads per in. L.H.
High Pressure Steam Cylinder
Low Pressure Air Cylinder

FIG. 11. DETAILS OF CYLINDER RE-BORING TOOL

they are slipping into position, and prevents them from rusting in place. The chain *F* is attached to any convenient projection and drawn around the base of the gear housing so that the latter will not revolve around the shaft instead of driving it. A feature of the device is that it can be used just as well for pushing the bushings out of valve chambers by reversing the positions of the flange and feed screw nut bracket and repeating the operation in the reverse direction.

After cylinder bushings have been bored they are placed in a lathe and the outside turned to the correct diameter for their cylinder fit. Special centering plates have been made for holding the bushings in a lathe while they are being turned. Each center is similar in design to a truncated cone with many steps upon which bushings bored to standard sizes may be fitted. The general dimensions of the centers are shown in Fig. 8.

A pneumatic clamping device, developed for holding the barrels of piston valves while the end caps are being removed, is shown in Fig. 9. It has proved a useful rig and is almost constantly in service when piston valves are overhauled. The illustration shows the manner in which two serrated jaws *A* grip the center of the piston barrel *B*, holding it securely while the nuts are being removed from the piston rod. In order to accommodate different sizes of barrels the lever of the upper jaw may be adjusted on its fulcrum *C* by stepping the bearing pin up or down into and one of the series of holes provided. The lever is operated by the piston of a 12-in. air cylinder *D* mounted on a floor column at the right of the stand. Suitable air valves are provided to control the clamping pressure exerted by the air cylinder. The standards used for the frame upon which the device is mounted consist of two cast gray iron bench legs of the stock form used for vise benches throughout the machine shop. Some of the socket wrenches used for removing the piston nuts can be seen at *E* on the lower shelf of the stand.

Boring Tool for Air Pumps

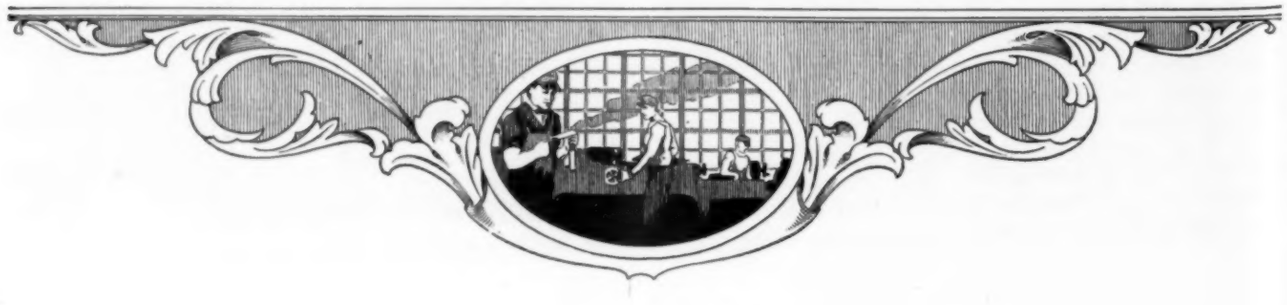
The portable tool for re-boring air pumps, shown in Fig. 10, has recently been completed, being made according to a design that has been very generally followed by railroad toolroom foremen. The parts used in its construction are detailed in Fig. 11. This device permits re-boring an air cylinder without the labor and loss of a gasket, as is the case when the steam cylinder is removed so that the air end may be placed in a vertical boring mill.

The device has a heavy cast bracket *A*, Fig. 10, that can be bolted to the stud holes in the end of the air cylinder. It carries all of the gearing and mechanism and can be adjusted so as to center the boring bar in the cylinder. The boring bar passes through the piston bushings and is supported by a similar bracket bolted to the end of the steam cylinder. Driving power is provided by an air motor that fits on the spindle of the first pinion shaft. Two gear reductions of a two to one ratio each are provided, making a total reduction of four to one. A double-end toolarm is provided in order to balance the thrust of the cuts. It is fed along the boring bar by a feed screw *B*, held in the stationary end supports *C* and actuated by the star wheel *D*.

An Adjustable Boring Tool Holder

By Leslie F. Tourtellotte

On page 111 of the *American Machinist*, Harry Moore has an article under the above title. The idea is fine; but if Mr. Moore would make the boring head fit the thread on the spindle of the milling machine the same as a chuck fits a lathe spindle instead of using the taper shank, he will greatly increase the efficiency of the device, as it will bore a smoother, straighter hole and take a heavier chip with less tendency to chatter.



Some Novel Grinding Fixtures

Grinding Blocks with Ends Parallel—A Fixture That Failed and How the Trouble Was Remedied—Inaccuracy Due to Warping

BY ANDREW MACNAB

IN a certain machine which is built in an English shop, a number of so-called "spacer blocks" are used. In some of the machines there are as many as twenty-nine and in others as few as nine of these blocks. The

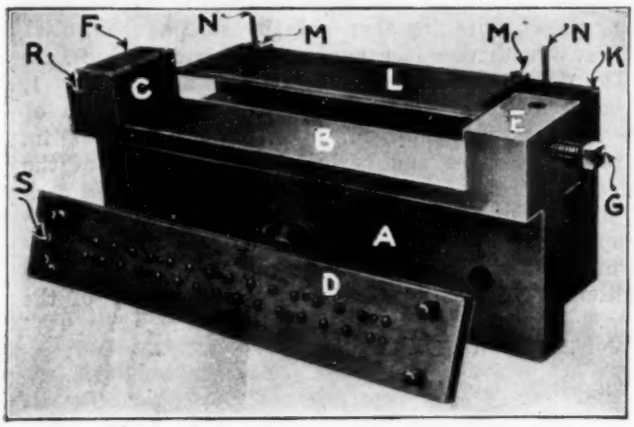


FIG. 1. THE GRINDING FIXTURE OPEN READY FOR CHARGING

functions of all the spacers are the same as are also the requirements which govern their manufacture. Their ends must be as nearly parallel to each other and the length of each block in a set of spacers must be as nearly the same as it is commercially possible to grind them.

The thicknesses and widths of the spacer blocks vary from ½ to ¾ in. and from 1¼ to 1½ in., respectively. On these dimensions a tolerance of plus or minus 0.005 in. is permissible. But the lengths, from 1⅛ to 5¼ in., inclusive, must be within 0.001 in. of nominal size and the opposite ends of the blocks must be as nearly parallel as it is possible to get them by grinding.

THEORETICAL AND PRACTICAL FIXTURES

The first grinding fixtures for the spacer blocks were so made that the spacers rested on their ends. Provision was made so that their sides and edges were set square to the surface on which their ends rested. It was expected of this fixture that after one end had been ground the spacers could be taken out, turned over, re-clamped and the other end ground not only to correct length but parallel to the surface previously ground on the other end. Theoretically the fixture was all right but in practice it was found that one could not make the two settings and get the ends anywhere near parallel, no matter how square the fixture surfaces were nor how carefully the setting was done. Even after surface grinding the sides and edges of the spacers square before setting them in the fixture, the end surfaces were anything but parallel to each other. For this reason it was decided to design new fixtures but before starting on them the designer decided that the weak point of the old idea was the double clamping feature. For this reason he set out to design a fixture in which the spacers would be set and clamped but once and in which setting they could be ground on both ends without removal from the fixture.

The obviously correct method of grinding would have been to pass the fixture containing the spacers between two abrasive wheels which would operate on the opposite ends simultaneously. This would have involved the building of a special machine which was out of the question as we have a Pratt & Whitney vertical surfacing machine grinder that is quite capable of handling the work.

With the above mentioned requirements for the work and limitations as to the machine to be employed, the fixtures shown in the illustrations were designed and have produced satisfactory work. The method employed to locate the spacers in the fixture is new to me and may possibly also be to those who read this, as I have been unable to find anyone who has seen it.

In Fig. 1 the fixture is shown open with the top cover off ready to receive the spacer blocks. The body of the fixture is cast iron machined all over and accurately ground on the following surfaces. The face marked *A* is parallel to the face immediately behind it. The surface *B* is square to both of these faces. The face *C* is square to *B* in the one direction and square to the surface *A*, and its opposite, in the other direction.

The member *D* is a steel plate cover for the recess between *F* and *E*. It is held to the fixture body by four capscrews which may be seen projecting through the holes in its corners. The recess between *E* and *F* is large enough to accommodate thirty of the ½ x 1½-in. spacer blocks 4½ in. long. The spacer blocks are placed on edge in the recess and while their edges are forced against the surface *B* the setscrew *G* is tightened, clamping all of the blocks against the surface *C* at the other end of the recess.

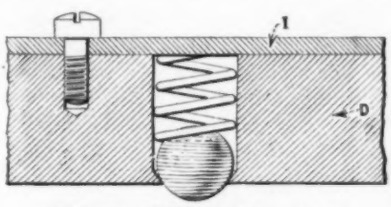


FIG. 2. DETAIL OF BALL PLUNGERS

The member *D* acts as a cover for the opening between *E* and *F*. When this cover was first made a

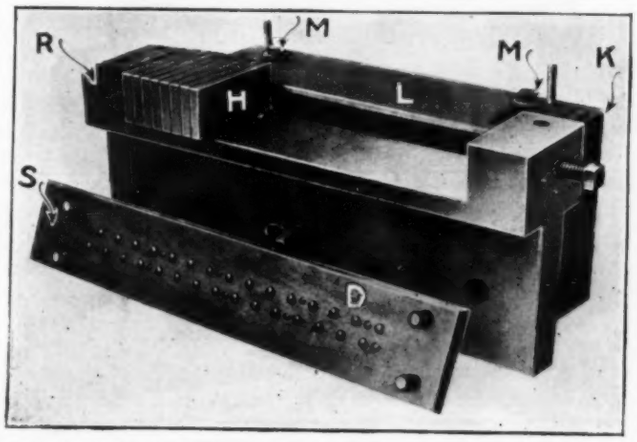


FIG. 3. FIXTURE WITH SOME OF THE SPACERS LOCATED AGAINST STRAIGHTEDGE

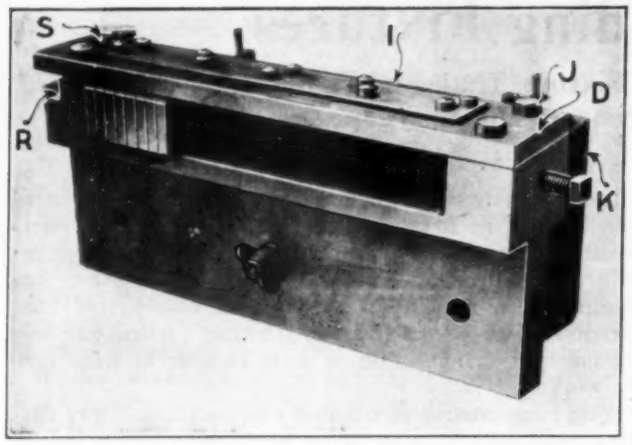
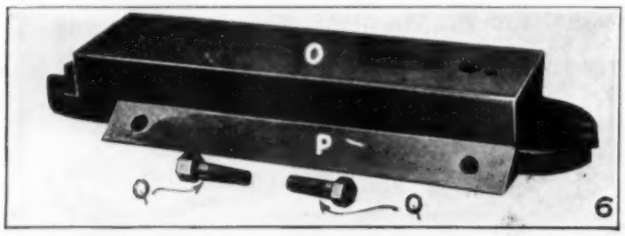


FIG. 4. FIXTURE WITH SOME SPACERS PLACED AND COVER IN PLACE

number of holes were drilled and tapped through it and so located that a setscrew in each of them would bear against the center of the edge of one of the spacer blocks. This would force the other edge of the spacer block against the surface *B* of the fixture and assure its being square in one direction with the surface *A* and the other surface behind it. A setscrew *G* at the end would then clamp all the spacing blocks against the surface *C* and assure that the spacing blocks were square in the other direction with the surface *A* and the one behind it. On trying this out however it was found that as each spacing block was put in and its screw tightened, the screws tightened against the previously located spacing blocks were loosened and the act of tightening had to be gone over several times, and that even then there was no way of equalizing the pressure, as some of the spacer blocks would be quite loosely held while others would be held too tight.

On making this discovery the designer removed the setscrews and drilled the threaded holes out so that they would be an easy fit for a $\frac{3}{8}$ in. steel ball.

The holes were drilled $\frac{23}{64}$ in. in the following manner: The end of a $\frac{23}{64}$-in. drill was flattened leaving about $\frac{1}{64}$ in. of the original point angle at the edge. A piece of hardened steel was then placed on the drilling machine table to act as a stop. The cover *D* was then placed on the hardened piece of steel and the drill run into each hole till it was brought up by its flattened



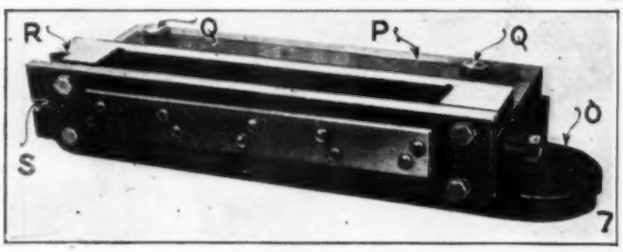


FIG. 6. TABLE OR ADAPTER FOR GRINDING MACHINE.
FIG. 7. GRINDING FIXTURE SECURED TO ADAPTER OR TABLE

end coming in contact with the face of the hardened steel piece. This left a small internal angular flange which served to retain the ball in the hole.

Into the holes thus made $\frac{3}{8}$-in steel balls were dropped and behind each was placed as stiff a compression spring as we could make to go freely into this small hole. On top of the springs the $\frac{1}{4}$-in. cold-rolled steel plate *I*, Fig. 2, was located and secured with fillister-head screws.

When assembling the spacing blocks in the fixture preparatory to grinding them, the cover *D* was removed as shown in Figs. 1 and 3. The spacing blocks were then placed close together side by side as shown at *H* Fig. 3 with one face against the straightedge *L*.

The depth of the recess between *E* and *F*, Fig. 1, is but a few thousandths greater than the width of the spacers. As the $\frac{3}{8}$-in. balls project about $\frac{1}{8}$ in. through the holes and beyond the inner face of the cover *D* there is available a clamping pressure on each of the spacer blocks equal to the power necessary to compress the spring $\frac{1}{8}$ in. Further this spring pressure is flexible and self adjusting, requires only the tightening of the four capscrews at the ends of the

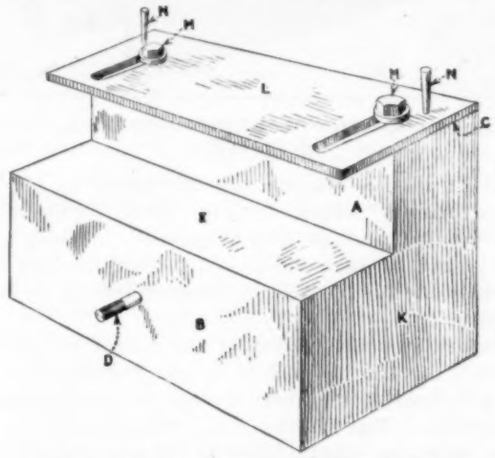


FIG. 5. DETAIL OF SETTING FIXTURE

cover *D* and needs no following up to see that all the spacer blocks are uniformly held.

After all the spacer blocks are placed, the cover *D* is located on top and the four cap screws *J* Fig. 4 are tightened. As these screws are screwed down each ball comes in contact with its spacer block and forces it against the face *B*, Fig. 1, of the fixture. Owing to the stiffness of the springs the spacer blocks are held with great firmness against the surface *B*.

After the cover *D* is clamped tight the setscrew *G* is tightened enough to hold the spacer blocks against shifting under the stresses due to grinding.

Before going further I should explain the setting fixture used in conjunction with the grinding fixture when setting the spacer blocks ready for grinding.

This setting fixture is also made of cast iron and is in box form with walls about $\frac{3}{4}$ in. thick so that it will not be too heavy to handle. It is shown at *K* in Figs. 1, 3 and 4 and in the perspective view Fig. 5.

Referring to Fig. 5 the surface *A* is planed parallel to the surface *B*, although no great degree of accuracy is required on any part of the body of this fixture. The surface *C* is planed approximately square to the face *A* and parallel to the planed surface *E*. A stud *D* is screwed into the center of the face *B* and is used to secure the grinding fixture in place against the

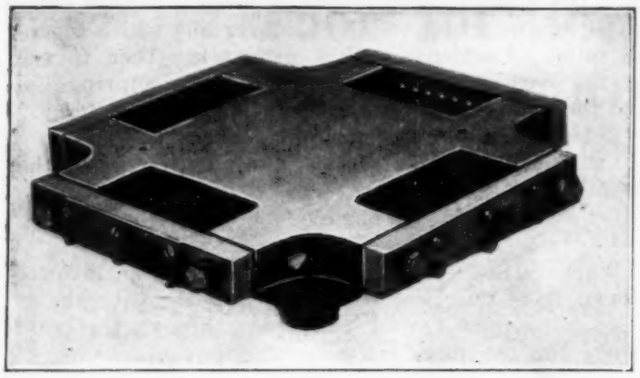


FIG. 8. TOP OF FOUR-SIDED GRINDING FIXTURE

face *B* while the spacer blocks are being assembled, as shown in Figs. 1, 3 and 4.

A straightedge *L* of $\frac{7}{16}$-in. steel is located on the surface *C* so that its edge is parallel to the surface *B*, Fig. 5. As the grinding fixture is secured to the surface *B* during the assembling operation this means that the edge of the straightedge *L* is parallel to the surface *A* of the grinding fixture, Figs 1, 3 and 4.

Two capscrews *M* Figs. 1, 3 and 5 are used to hold the straightedge in place but it is located for each size of spacer block by two taper pins *N*, one at each end. These fit in holes through the straightedge and the setting fixture body. Slots are provided in *L* for the capscrews *M* so that they need be only slackened when re-adjustments of the straightedge are being made. Separate taper pin holes are provided through the straightedge *L* and setting fixture body for each size of spacer block to be set in the grinding fixtures.

As previously stated grinding is done on a Pratt & Whitney vertical surface grinding machine. To enable the fixture to be used on this machine the adapter or table *O*, Fig. 6, was made. This table can either be bolted direct to the platen of the machine or it can be held by the magnetic chuck; we have used it both ways.

The grinding fixture is held to the adapter by the two capscrews shown. The top of the table *O* was made about $1\frac{1}{4}$ in. thick so that if necessary a cut can be taken over it each time it is replaced on the grinding machine, thus insuring the flatness and accuracy of its top surface and its parallelism to the path of traverse of the machine table. It will be noted that there is a strip of $\frac{1}{8}$-in. cold-rolled flat steel *P* with a hole near each end. This is merely a long double washer which is placed under the two capscrews used to hold the grinding fixture to the table. It is made in this form so that the surfaces around the capscrew holes in the grinding fixture will not be marred as they would be by ordinary washers which would be likely to turn with the capscrews and throw up burrs. These burrs would not only mar the fixture but they would prevent it from seating on the table properly when it is turned over for the second cut thus producing inaccurate work.

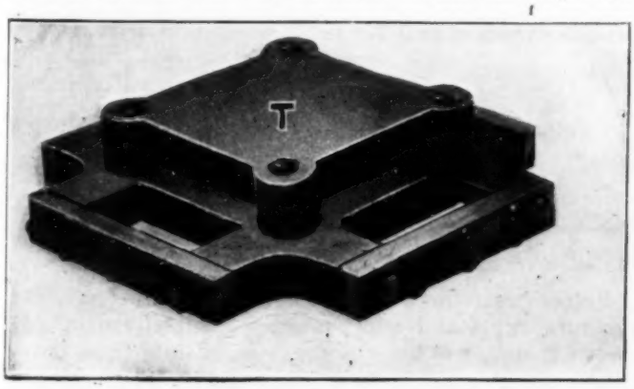


FIG. 9. BOTTOM OF FOUR-SIDED GRINDING FIXTURE SHOWING ADAPTER

After the fixture is secured to the table, as shown in Fig. 7, the top surfaces of the spacer blocks are ground till all of them are cleaned up. The two capscrews *Q* are then released and the fixture turned over and again fastened to the table *O*, in which position the other ends of the spacer blocks are ground to a finish.

As the surface *A*, of the grinding fixture, Figs. 1 and 3, and the one behind it are parallel and as the surface of the table *O* Fig. 6, is parallel to the traverse of the grinding wheel, the surfaces of the ends of the blocks must also be parallel to each other.

It will be noted that a species of V-block has been worked out of the fixtures body as at *R* Figs. 1, 3 and 4. The sides of this V-block *R* are accurately square in both directions to the surface *A* of the fixture. It will also be noticed that there are three holes *S* in the cover *D* above the V-block. These holes are tapped to accommodate three setscrews. The rough blanks for the spacers are cut about $\frac{1}{16}$ in. longer than finished size and after they are placed in the fixture the operator takes a grinding gage and sets it in the V-block fastening it with the three setscrews. These grinding gages are made of cold rolled steel. They are ground to length and their ends are coated with sulphate of copper.

The grinding machine operator grinds the first surface of the spacer blocks till the wheel just touches the coppered face of the grinding gage. When he turn the fixture over and grinds the other surface he again brings his wheel down till it just touches the coppered surface of the other end of the grinding gage. In this manner no calipering is necessary and the work is easily brought within the required limits. In this work the limits are for the $5\frac{1}{4}$-in. size, within 0.002 in. The important matter is to get all the spacer blocks of a lot as nearly the same length as it is possible to grind them. If the grinding is carefully done and the operator takes precautions not to let his wheel "ride" over the surface, a charge of blocks can be easily brought within 0.0005 in. of uniform size.

In Fig. 8 is shown another modification of this same principle. In this case the spacer blocks are divided into four groups. Two groups of eight spacer blocks each and two of seven blocks each. Fig. 8 shows the top of the fixture and Fig. 9 the bottom. With this fixture no adapter or table is used, or rather the adapter is, during the first grinding operation, secured direct to the fixture. The table *T*, Fig. 9, is fastened to the fixture by four screws, located in counterbored holes, so that their heads are below the surface. When grinding the operator places the table *T* direct on the magnetic chuck. The top ends of the spacer blocks are then ground and when they are cleaned up the operator removes the fixture from the magnetic chuck, takes out the screws which hold the table to the fixture and, with the table removed, places the fixture back on the magnetic chuck again. This time the previously ground surfaces of the spacer block ends rest directly on the magnetic chuck. If the magnetic chuck is true the work is bound to come parallel.

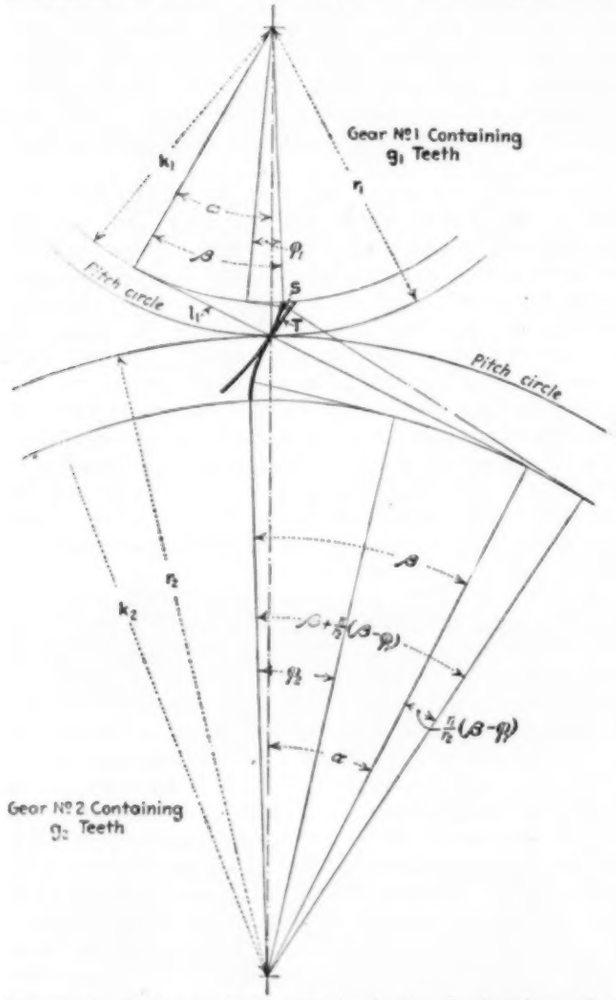
Two grinding gages are used with this fixture. They are made from blocks which have been spoiled on the fixtures previously used. By laying them on the steam hammer anvil and striking them a blow they can be lengthened sufficiently to make grinding gages of them.

In work of this kind one cannot be too careful to eliminate all the possible causes of trouble. A number of spacers came from the new fixture with their end faces out of parallel. On close examination it was found that they had been slightly bent before they were clamped in the fixture, in some cases only a few thousandths, but when clamped in the fixture they were forced straight. While they were in the fixture their end surfaces were parallel after being ground, but as soon as the clamping screws were released they resumed their original shape which threw the end surfaces out of parallel. This trouble was overcome by surface grinding the sides before placing them in the grinding fixture.

Angles of Approach, Recess and Contact of Involute Gears—Discussion

BY J. M. LABBERTON

In an article by A. B. Cox in the *American Machinist* on page 559, Vol. 54, a method of calculating the angles of approach, recess and contact in involute gears was described. This method required the derivation of a special formula for the involute and was confined to gears having addenda the same for both gear and pinion.



In the following paragraphs is given a method originated by the writer which is simpler and which covers all ratios of addenda. This method has been in use by the Westinghouse Electric and Manufacturing Co. and the R. D. Nuttall Co. for several years.

Referring to the accompanying figures:

Let r_1 and r_2 be the radii of the pitch circles of the gears shown, and

Let α be the pressure angle.

$$l_1 = a_1 = r_1 \sin \alpha.$$

Where k_1 is the radius of the base circle, an involute drawn from this base circle will take the path shown if it is assumed that it must pass through the point where the two pitch circles coincide.

$$\text{But the angle } \beta = \frac{r_1 \sin \alpha}{k_1} = \frac{r_1 \sin \alpha}{r_1 \cos \alpha} = \frac{\sin \alpha}{\cos \alpha}$$

Therefore, angle $\beta = \tan \alpha$; or in other words, the radian value of β is numerically equal to the tangent of the pressure angle.

Consider the angle ϕ_1 and that section of the involute generated by the evolute of the arc of $(\beta - \phi_1)$. This section of the involute makes contact during the angle of approach, and therefore $(\beta - \phi_1)$ is the angle of approach. The arc of ϕ_1 is the evolute of that section of the involute adjacent to the base circle which never makes contact. It is conceivable that ϕ_1 can be zero, but if less than zero there is no involute and interference occurs.

That portion of the involute above the pitch circle is generated by an angle equal to the angle of recess. But this portion of the involute on gear No. 1 mates with that section of the involute of gear No. 2 generated by the angle $(\beta - \phi_2)$. Therefore, the angle of recess of the No. 1 gear is $\frac{r_2}{r_1}(\beta - \phi_2)$.

Study of the figure will disclose that the addenda are:

For gear No. 1, $k_1 \sqrt{\left[\beta + \frac{r_2}{r_1}(\beta - \phi_2)\right]^2 + 1} - r_1$

For gear No. 2, $k_2 \sqrt{\left[\beta + \frac{r_1}{r_2}(\beta - \phi_1)\right]^2 + 1} - r_2$

The angle of contact being the sum of the angles of approach and recess, the angle of contact

$$C_A = \beta - \phi_1 \pm \frac{r_2}{r_1}(\beta - \phi_2).$$

As a summary we have the following formulas:

(1) β (in radians) is numerically equal to the tangent of the pressure angle, or $\beta = \tan \alpha$

(2) Angle of approach of gear No. 1 $= \beta - \phi_1$

(3) Angle of recess of gear No. 1 $= \frac{r_2}{r_1}(\beta - \phi_2)$

(4) Addendum of gear No. 1 $=$

$$k_1 \sqrt{\left[\beta + \frac{r_2}{r_1}(\beta - \phi_2)\right]^2 + 1} - r_1$$

(5) Addendum of gear No. 2 $=$

$$k_2 \sqrt{\left[\beta + \frac{r_1}{r_2}(\beta - \phi_1)\right]^2 + 1} - r_2$$

(6) $k_1 = r_1 \cos \alpha$

(7) $k_2 = r_2 \cos \alpha$

Proceed as follows in the solution of a problem: The pressure angle and addenda known substitute in (4) and (5), and solve for ϕ_1 and ϕ_2. Substitute these latter values in (2) and (3) to obtain angles of approach and recess for the No. 1 gear.

Tools for Boring and Turning Locomotive Tires—II

Rough and Finish Turning Tools—Solid Tools and Tools in Holders—Angles of Rake and Clearance Vary Greatly in Different Shops

BY FRED H. COLVIN
Editor, *American Machinist*

IT WILL be noted that the numbers in the table in this article do not correspond with those published in the table in Part I, so that in making comparisons, the *names* of the railroads, and not the numbers, should be noted. Form-finishing tools are used in each of these cases and details are given where they differ in construction. The following illustrations show the way in which these tools are made, in most cases.

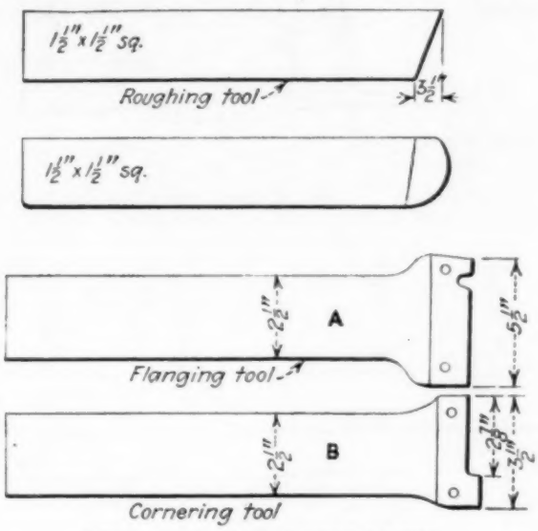


FIG. 10. ATLANTIC COAST LINE

No. 2. Both roughing and finshing tools of the Atlantic Coast Line R.R. are shown in Fig. 10, "rights" and "lefts" are of course necessary in the case of the form tools, though both are not shown. The first tool *A* finishes the flange, while *B* makes the regular bevel and also trims the outer corner. These tools have 1½- to 2½-deg. clearance.

TABLE II. TIRE TURNING DATA

Name of Railroad and Shop	Size of Tool Body in Inches	Top Rake of Tool, Degrees	Clearance at Point, Degrees	—Cutting Speed— Feet per Minute: Roughing	Finishing	Feed per Revolution in Inches, Roughing
Atlanta, Birmingham & Atlantic, Atlanta, Ga.	1¼x2½	10	5	10–15	10–15	¼–⅜
Atlantic Coast Line, Wilmington, N. C.	2½x2½	5	3½	17	17	½
Atchison, Topeka & Santa Fe, Topeka, Kan.	2 x 3	12	15	16–18	18	¼
Bessemer & Lake Erie, Greenville, Penn.	1½ x 3	2	4	11	11	¼x½
Chicago & Alton, Bloomington, Ill.	1½ x 3	8	6	16	12	½
Chicago & Northwestern, Chicago, Ill.	1½ x 3	4 to 6	6 to 8	13	13	½
Canadian Pacific, Montreal, Can.	1½ x 3	6	6	15	17	½
Chicago, Rock Island & Pacific, Silvis, Ill.	1½x2½	5	5	12	12	5/16
Denver & Rio Grande, Burnham, Colo.	1½x2½	8	6	17	17	¼
Grand Trunk, Battle Creek, Mich.	1½x 3	5	5	15	15	¼
Grand Trunk, Montreal, Can.	2 x 3	5	5	13 7	13 7	¼
Hocking Valley, Columbus, Ohio	1½x 2	2 to 3	7	14	14	¼
Lehigh Valley, Bethlehem	2 x 3	7	8	12–20	12–20	¼
Norfolk & Western, Roanoke, Virginia	2 x2½	6	6	16	16	¼
New York, New Haven & Hartford, Readeville, Mass.	1½x 4	2	7	50	45	½
New York Central, Depew, N. Y.	1½x1½	11	4	14–18	14–18	5/16
New York, Ontario & Western, Middletown, N. Y.	1½x 3	12	6	15	10	5/16
Pennsylvania, Olean, N. Y.	1½x 3	3	5	13½	12½	¼
Philadelphia & Reading, Reading, Penn.	1½x 3	2	5	18	12	¼
Wabash, Decatur, Ill.	1½x 3	2	5	15	17	½

No. 3. Full details of the form-cutting tools for the tire treads, and the holders which support them are given in Fig. 11. These tools come from the Atchison, Topeka & Santa Fe Ry. and show the contours for road engines and tenders, for switching engines and for car wheels. As dimensions are similar on both right- and left-hand tools—they are not given in both cases.

No. 4. The contour of the standard form of tire is shown at *A* in Fig. 12. The tools used by the Bessemer & Lake Erie R.R. are also shown, including the roughing tool at *B* which

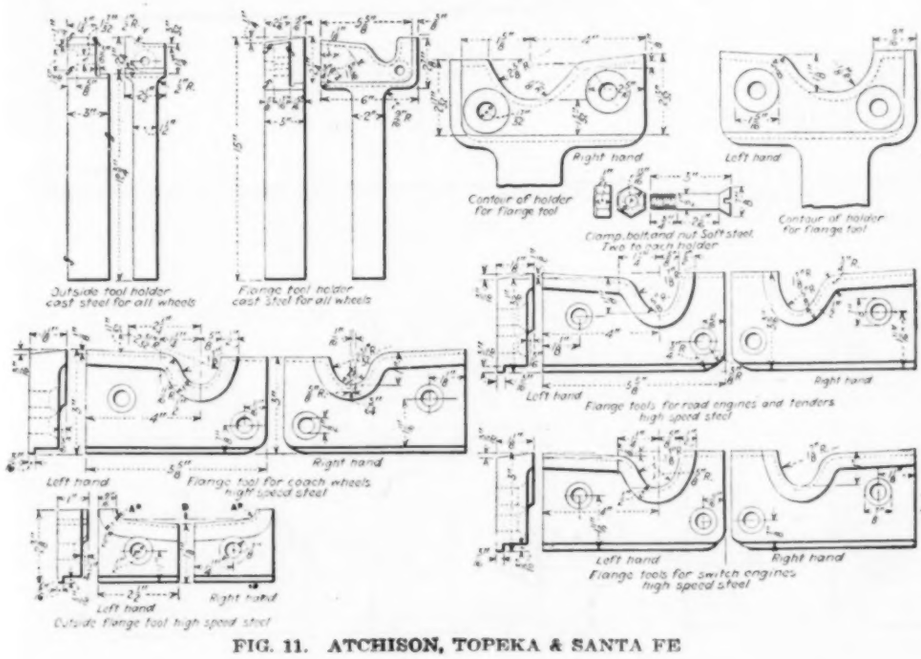

Outside tool holder cast steel for all wheels
Flange tool holder cast steel for all wheels
Right hand
Contour of holder for flange tool
Clamp bolt and nut Soft steel Two to each holder
Left hand
Contour of holder for flange tool
Left hand
Flange tool for coach wheels high speed steel
Right hand
Left hand
Flange tools for road engines and tenders high speed steel
Right hand
Left hand
Outside flange tool high speed steel
Right hand
Left hand
Flange tools for switch engines high speed steel
Right hand

FIG. 11. ATCHISON, TOPEKA & SANTA FE

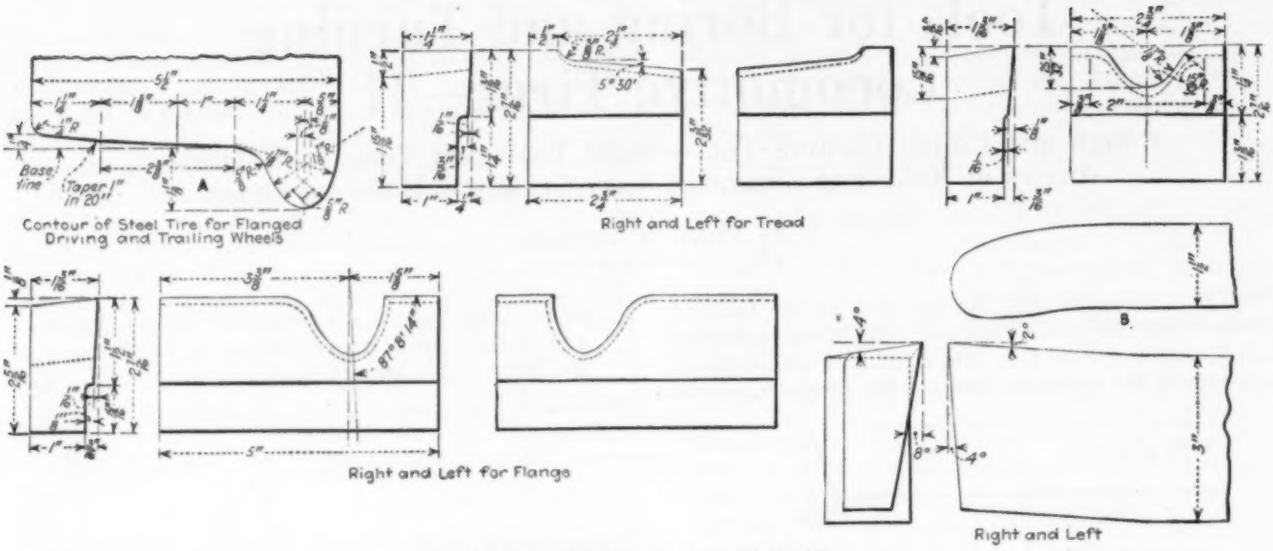

Contour of Steel Tire for Flanged Driving and Trailing Wheels
Right and Left for Tread
Right and Left for Flange
Right and Left

FIG. 12. BESSEMER & LAKE ERIE

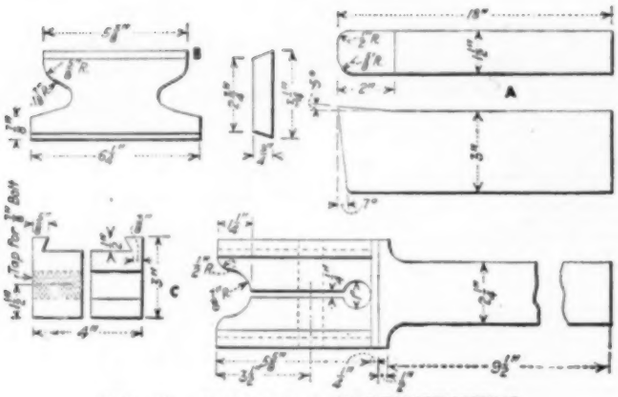


FIG. 13. CHICAGO & NORTHWESTERN

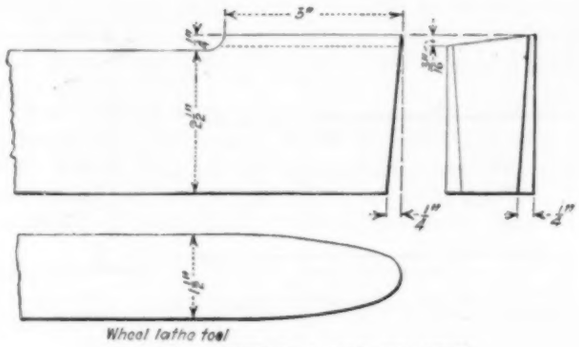


FIG. 16. DENVER & RIO GRANDE

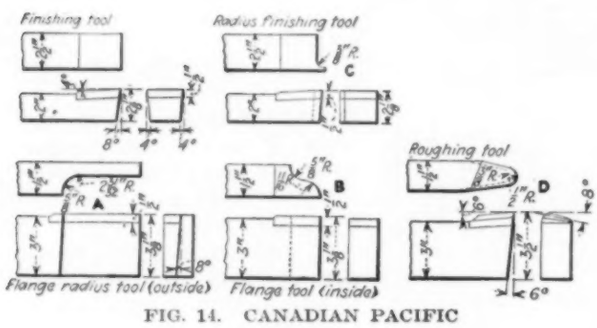


FIG. 14. CANADIAN PACIFIC

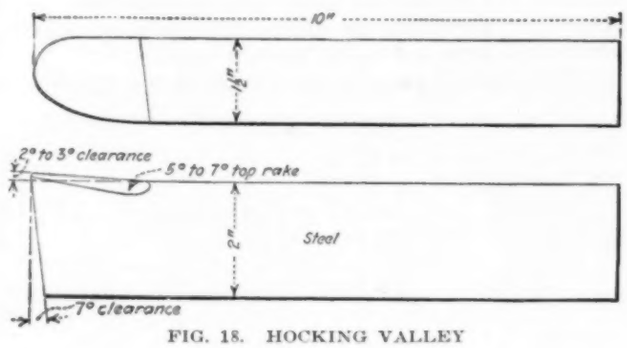


FIG. 18. HOCKING VALLEY

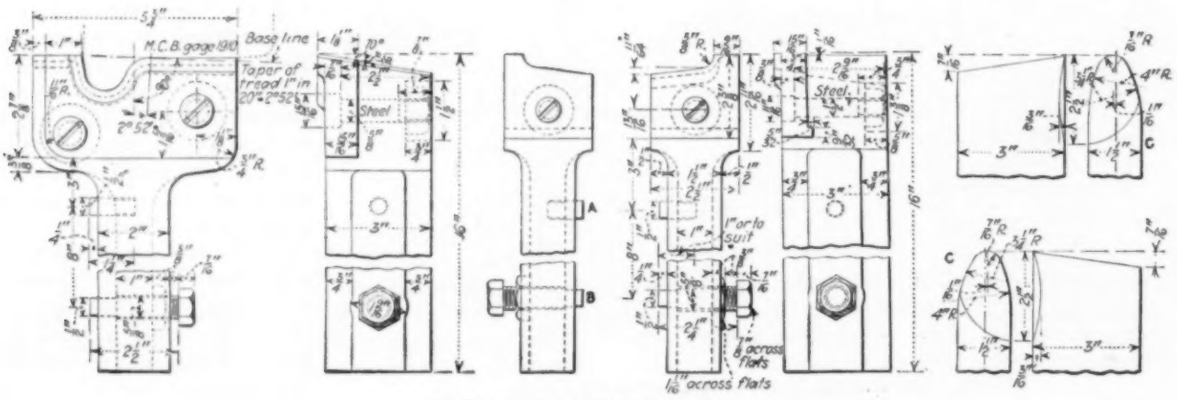


FIG. 19. LEHIGH VALLEY

has a top rake of 2 deg. and a side clearance of 8 deg. on both right- and left-hand tools. The form tools are also shown. These tools have finished a pair of 54-in. tires in 37 min. on a Sellers wheel lathe with turret head tool-holder.

No. 5. The roughing tool of the Chicago & Alton R.R. has a $\frac{3}{4}$-in. radius. Form finishing tools are used in the usual manner, one covering the flange and half the tread, the other finishing the tread and the corner radius.

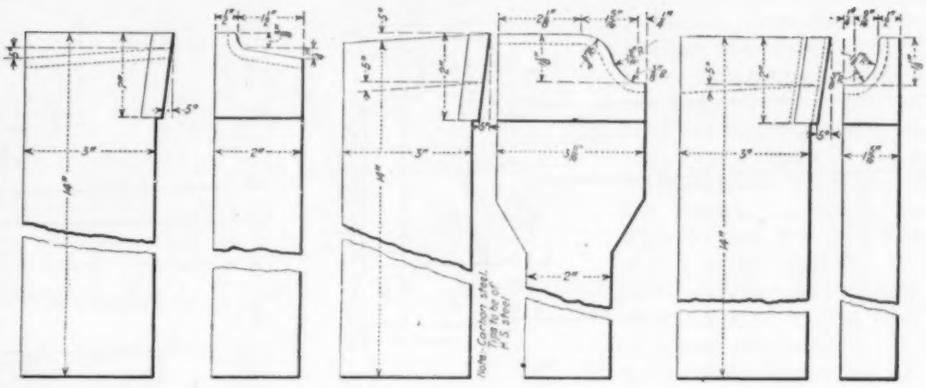


FIG. 17. GRAND TRUNK

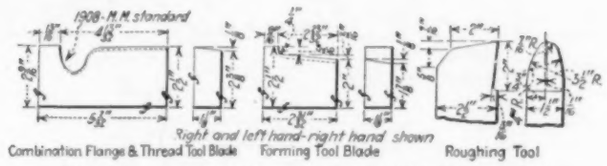

1908 M.M. standard
Right and left hand-right hand shown
Combination Flange & Thread Tool Blade
Forming Tool Blade
Roughing Tool

FIG. 15. CHICAGO, ROCK ISLAND & PACIFIC

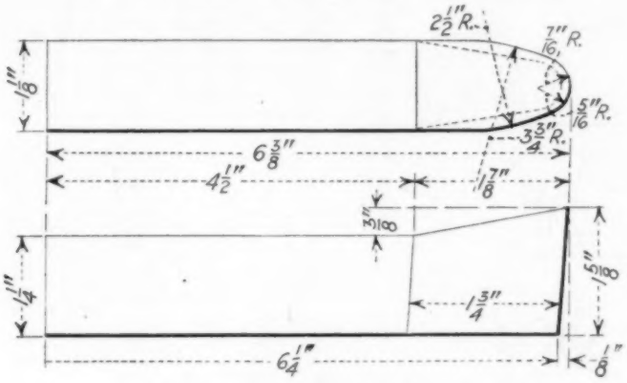


FIG. 22. NEW YORK CENTRAL

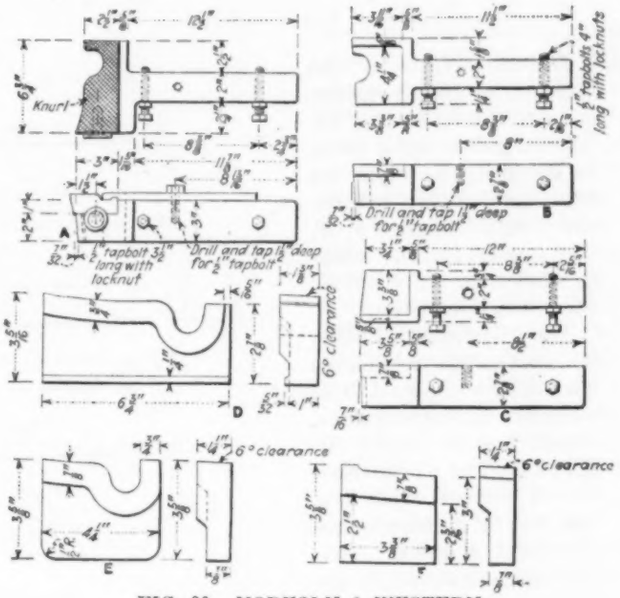


FIG. 20. NORFOLK & WESTERN

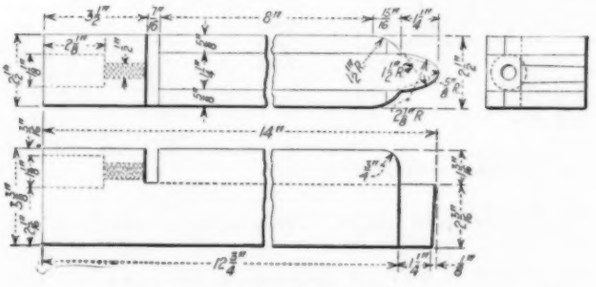


FIG. 23. NEW YORK CENTRAL

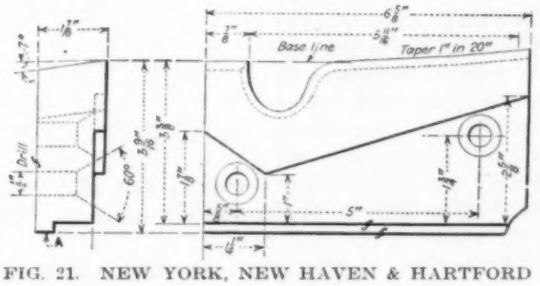


FIG. 21. NEW YORK, NEW HAVEN & HARTFORD

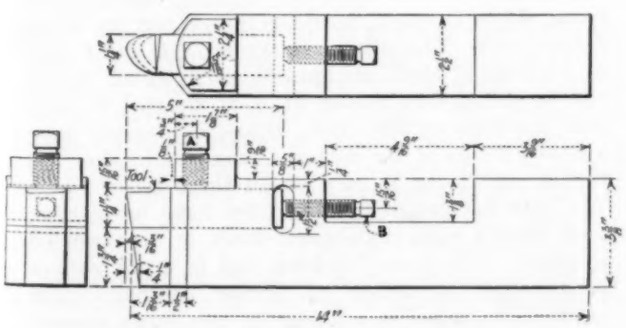


FIG. 24. NEW YORK CENTRAL

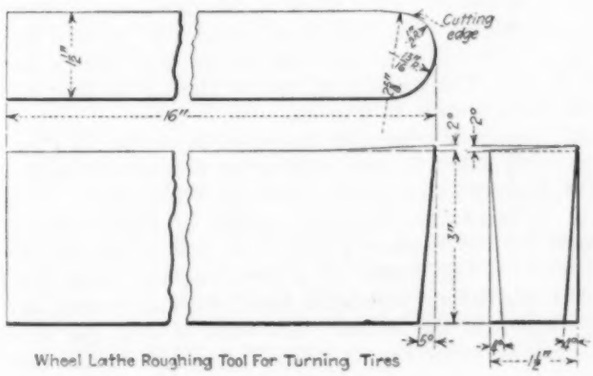


FIG. 29. WABASH

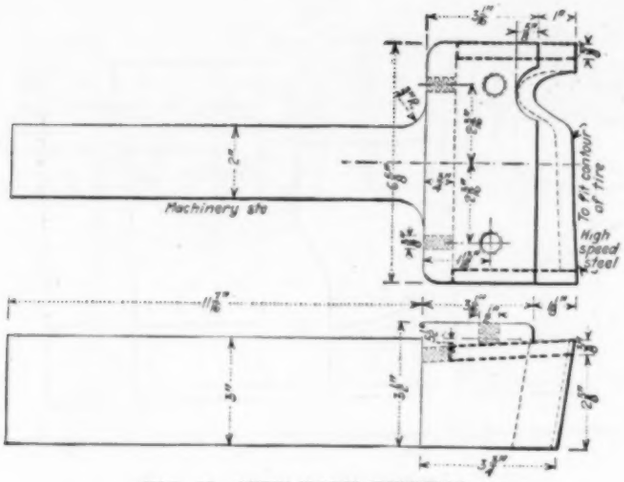


FIG. 25. NEW YORK CENTRAL

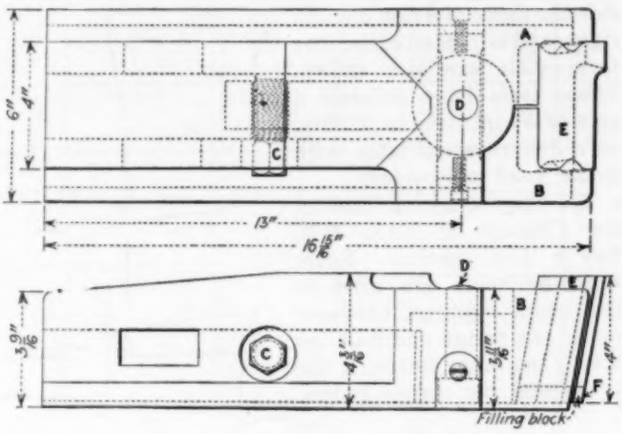


FIG. 27. PENNSYLVANIA

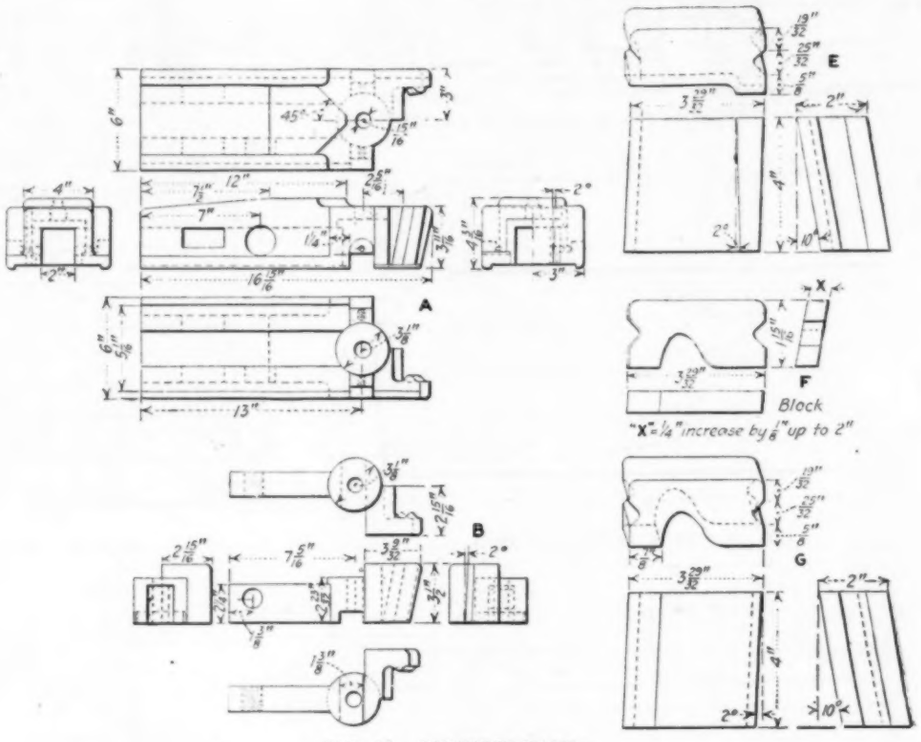


FIG. 26. PENNSYLVANIA

No. 6. Different tools of the Chicago & Northwestern Ry. are shown in Fig. 13. The roughing tool is given in detail at *A*, while the double ended form tool for the flange is shown at *B*. The holder for the latter is shown at *C* with all necessary dimensions.

No. 7. The Canadian Pacific Ry. uses mild steel shanks with high-speed steel welded to the cutting edge, details being shown in Fig. 14. The wheel tread is not formed with one tool, but by successive use of tools *A*, *B* and *C*. This view also shows the roughing tool at *D*.

No. 8. In addition to the top rake and clearance shown in the table, a side rake of 7 deg. is given to the cutting edge of tools used by the Chicago, Rock Island & Pacific Ry. The cutters for finishing and the forming tool outlines are shown in Fig. 15. These cutters slip into a holder which supports them firmly while in the cut.

No. 9. The outline of the rough turning tool of the Denver & Rio Grande R.R. is shown in Fig. 16.

No. 11. The Grand Trunk shops at Montreal use carbon steel shanks with high-speed steel tips welded in place. The dimensions and forms are shown in Fig. 17. The method of use is similar to that of the tools shown in Fig. 14.

No. 12. The rough turning tool used is shown in Fig. 18. Finishing is done with a flat formed tool as is the usual practice of the Hocking Valley Ry.

No. 13. A somewhat different design of form tool is used by the Lehigh Valley R.R. and is shown in Fig. 19. The holder is a steel casting made for both right- and left-hand tools, with a channel or I-section in the shank. The stud *A* and the set-screw or stopscrew *B* make it easy to locate the tool in the holder and to swing it sideways so as to get the right angle. The roughing tool is shown at *C*.

No. 14. There is nothing unusual in the roughing tool of the Norfolk & Western Ry., but the form finishing tool is rather unique in its construction as can be seen in Fig. 20. Three types of holders are provided, the one at *A* being for forming the complete tread, while *B* and *C* form the flange and the bevel respectively. The cutters shown at *D*, *E* and *F*, are of high-speed steel, clamped in place as at *A*. It will be noted that holder at *A* is knurled to help hold the form cutter. Both *B* and *C* however have a raised flange at the side and rear which takes the thrust. A clamp is used on all these tools.

No. 15. Tools for rough turning tires have low-carbon steel bodies with high-speed noses or tips welded in place. The form finishing tool is made with a master milling cutter of proper contour. The cutter is fastened to a holder by two large screws, while the lip *A*, Fig. 21, which fits a groove in the

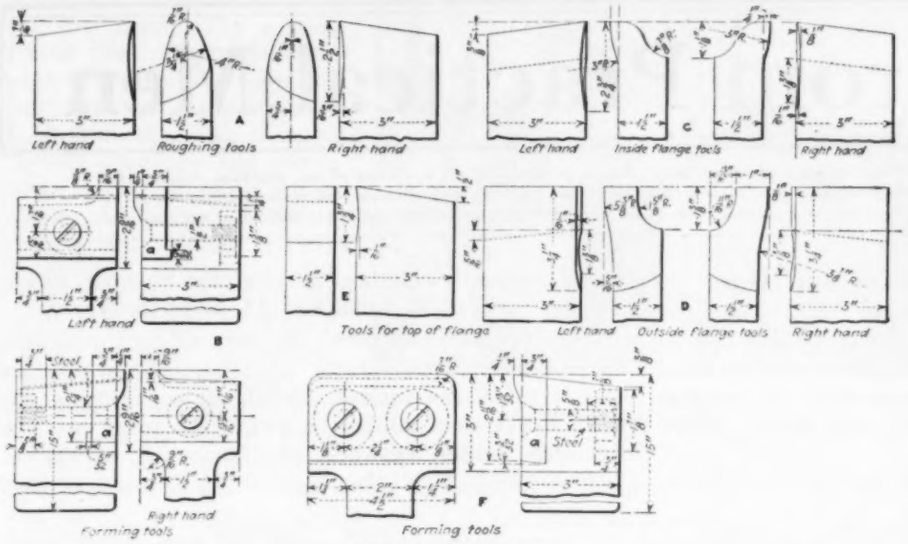


FIG. 28. READING

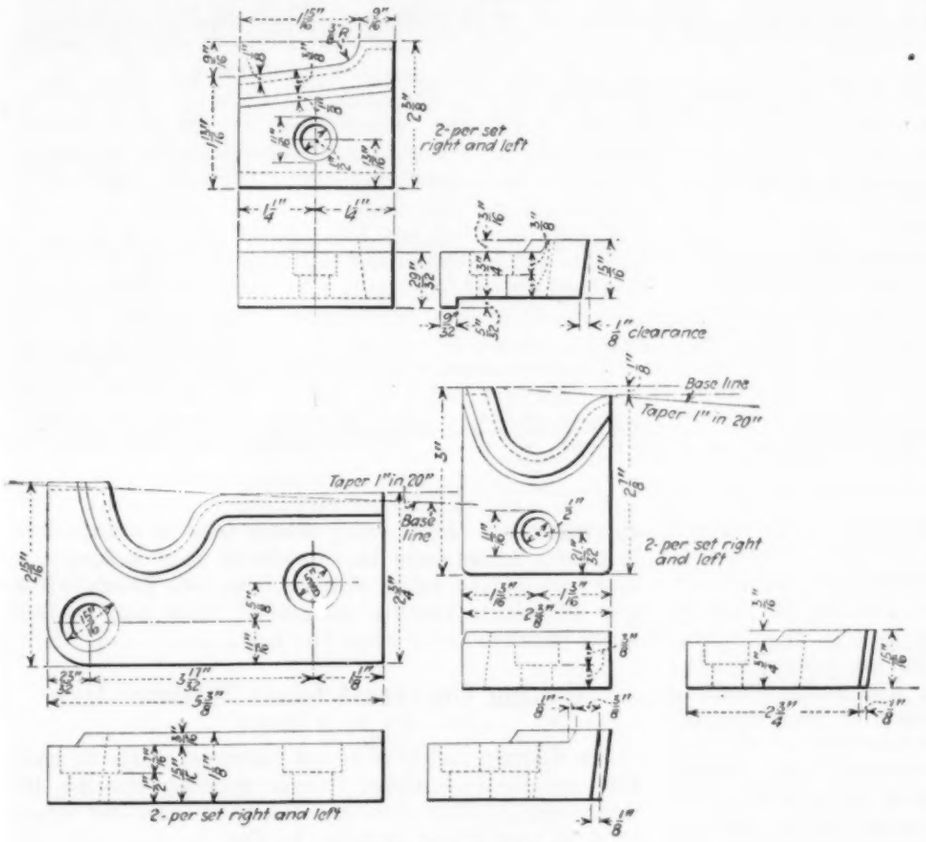


FIG. 30. WABASH

holder, both locates it and prevents any lifting under the heaviest cuts.

No. 16. The New York Central R.R. has several forms of tire turning tools. The solid tool is shown in Fig. 22, while Figs. 23 and 24 show two types of toolholders with inserted blades. The latter has the clamping screw *A* and adjusts the cutter by screw *B*. In Fig. 25 is the holder for the form tool used in finishing. This has a pocket, at a 5½-deg. angle to give top rake, and both adjusting and clamping screws. This makes a substantial holder, but one which would be expensive were it not for the use of electric welding in filling in the sides of the slot as shown by dotted lines. These sides complete the pocket which serves to hold the cutter against side thrust and to locate it with reference to the flange.

No. 18. This forming tool from the Pennsylvania R.R. is quite different from any of the others, as shown in Figs. 26 and 27. The first shows details and the second the assembled tool holder and cutter. This form of holder and cutter is used for both the flange and the outer edge of tire.

The cutter is made on the principle of the straight forming tools used in screw machine work, and is held at the angle which will give the desired clearance. Several views of each part are shown in the details. The body *A* forms the left-hand jaw of the holding mechanism, while *B* is the movable jaw or clamp. The reference letters are the same in both Figs. 26 and 27. Referring to Fig. 27 the body jaw *A* and movable jaw *B* clamp the cutter *E* by means of the screw *C*. The loose jaw swings on the pivot pin *D*. The tool *G* is for finishing the flange.

The cutters are sharpened by grinding on the top or flat surface. In order to keep the cutting edge at the proper height, blocks are made to slip in under the bottom of the cutter as at *F*. There are 15 of these blocks in a set, varying by ⅛ in. from ¼ to 2 inches.

No. 19. The tire turning tool practice of the Philadelphia & Reading R.R. differs considerably from most of the others, as can be seen in Fig. 28. It resembles the C. P. R. and Grand Trunk in some respects. The roughing tools *A* are about as usual, but several tools are used for finishing. The bevel and chamfer are turned with the tools at *B*, the inside of the flange with tools *C*, the outside with *D*, the top of the flange with *E* and the fillets beside the flange with *F*. These tools are made right and left except *F*, and *B* and *F* have high speed cutters. The cutters are shown at *a* in both *B* and *F*.

No. 20. The form of the Wabash Ry. rough turning tool is shown in Fig. 29 and the form finishing tool in Fig. 30. The latter shows three types of tools, one to finish a goodly portion of the tread, while the other shows a separate flange tool and one for the bevel and the rounded corner.

Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Slide Rule for Speeds, Feeds and Time

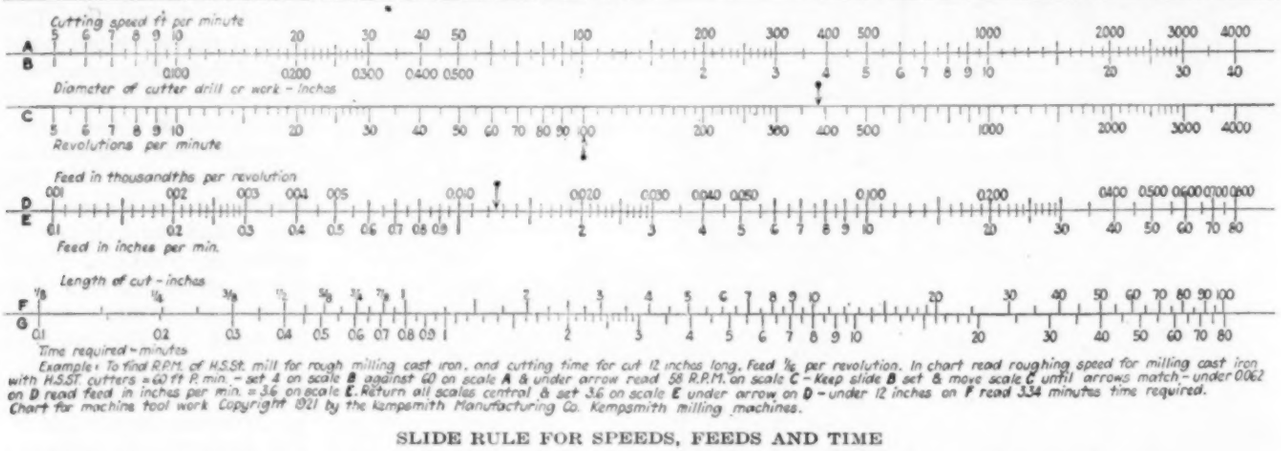
BY FRED A. PARSONS

The slide rule shown was developed by the Kempsmith Manufacturing Co. for the use of their foremen for estimating operation times, especially in milling-machine work, although it is well adapted for either milling, drilling or turning.

The particular point of interest is that it combines standards for cutting speeds with a very quick method of determining the proper r.p.m. of work or cutter to obtain these speeds. By manipulating the rule according to the example printed on the bottom, the feed in inches per minute for any given feed in thousandths per revolution may be read after having determined the required revolutions per minute, and another setting gives the cutting time for any length of feed required.

	MILLING						DRILLING		TURNING						
	R	F	R	F	R	F			R	F	R	F	R	F	
Malleable iron	60	75	90	100	135	170	50	70	90	100	130	150	200	240	
Cast iron - soft	40	50	60	70	90	110	35	50	60	75	90	110	135	160	
Cast steel - clean	30	35	45	55	65	80	25	35	45	55	65	80	100	120	
Steel bar - soft to 0306	60	75	90	110	135	170	50	70	90	110	130	160	200	240	
	Carbon		H.S.S.T.		Stellite		Carbon	H.S.S.T.	Carbon		H.S.S.T.		Stellite		

	MILLING						DRILLING		TURNING						
	R	F	R	F	R	F			R	F	R	F	R	F	
Tool steel - well annld	25	35	40	50	55	80	20	30	35	45	50	65	80	95	
Brass - yellow	75	95	110	150	170	200	60	90	110	150	160	220	250	300	
Bronze	40	50	60	70	90	100	35	50	60	70	90	100	135	160	
Alluminum	460	550	700	900	1000	1200	350	550	700	900	1000	1300	1500	1800	
	Carbon		H.S.S.T.		Stellite		Carbon	H.S.S.T.	Carbon		H.S.S.T.		Stellite		


Cutting speed ft per minute
Diameter of cutter drill or work - inches
Revolutions per minute
Feed in thousandths per revolution
Feed in inches per min.
Length of cut - inches
Time required - minutes

Example: To find R.P.M. of H.S.St. mill for rough milling cast iron, and cutting time for cut 12 inches long. Feed 1/16 per revolution. In chart read roughing speed for milling cast iron with H.S.ST. cutters = 60 ft P. min. - set A on scale B against 60 on scale A & under arrow read 58 R.P.M. on scale C - Keep slide B set & move scale C until arrows match - under 0062 on D read feed in inches per min. = 36 on scale E. Return all scales central & set 36 on scale E under arrow on D - under 12 inches on F read 334 minutes time required. Chart for machine tool work. Copyright 1921 by the Kempsmith Manufacturing Co. Kempsmith milling machines.

SLIDE RULE FOR SPEEDS, FEEDS AND TIME

The listed speeds bear definite relations or ratios to each other, and as determined by experiment and borne out in practice the ratios run about as follows:

(a) Finishing cuts about 20 per cent faster than roughing; when finishing in one cut use roughing speeds.

(b) Ratio of relative speeds for carbon, high-speed steel and stellite is about 1–1.5–2½ respectively.

(c) Ratios of milling, drilling and turning speeds are about 1–0.8 and 1.5 respectively.

Item (c) is determined by various considerations, for instance: simple tools as lathe tools, which are easy to grind and replace, should, for economy, be run much faster than milling cutters which must last considerably longer between grinds to be economical. Slower speeds must also be used for turning tools in automatic machinery, etc., where tools are expensive to reset. Drills must be run slower than milling cutters because the entire cutting is on two points which are difficult to cool by means of fluids and without much metal to carry away the heat.

Making Universal Joints Without Jigs

BY E. A. DIXIE

We recently had four rough universal joints to make for use in a machine. Their making entailed the machining of eight castings similar to the one shown at *A* in Fig. 1, and in detail in Fig. 2.

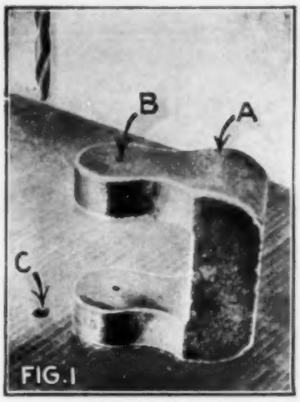
There was nothing fancy about the job, the requirements being that there should be no jigs and as little machine work as possible. With this in view it was decided to make the fulcrum blocks of 2 in. square cold-rolled steel cut 1⅞ in. long in the hacksawing machine and left just as they came from the saw.

The castings *A* were bored 1 in. as shown in Fig. 2 for the reception of the end of the shaft to which they were to be secured by means of taper pins. At the same operation the end was faced. They then went to the milling department where they were gripped in the milling machine vise and a 2-in. mill was passed between the jaws.

The blocks then went to the laying out table and the centers *B* were laid out with relation to the shaft

and the milled inside surfaces of the jaws. The centers were then center punched and the rest of the work was up to the drilling machine.

It will be noted that, as usual, some one had run a drill into the drilling machine table at *C*, Fig. 1. This hole *C* was utilized by the machinist to center the bottom of the jaw while he drilled the top. In Fig. 3 it will be noted that a steel ball *D* has been located in the hole *B*, and that in Fig. 4 the center punch mark or drilled hole in the bottom jaw has been located on the top of this steel ball. With the casting positioned in this way a $\frac{7}{16}$-in. drill was run through one jaw, then the yoke was turned over and the drill run through the other. This was followed by a $\frac{33}{64}$-in. drill as $\frac{1}{2}$-in. capscrews were to be used in assembling the joints.



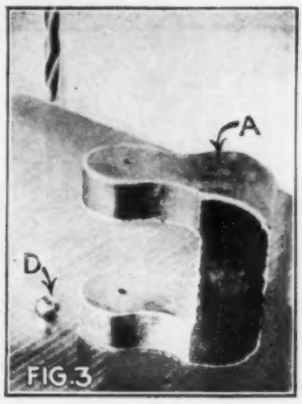


FIG. 1. YOKE AND HOLE IN MACHINE TABLE. FIG. 3. HOW BALL WAS USED. FIG. 4. YOKE CENTERED ON BALL READY FOR ENLARGING SMALL HOLE PREVIOUSLY DRILLED

As there was nothing particular about the accuracy of the blocks, the sole requirement being that they should be strong and work freely, one side of each of them was centered, drilled and tapped $\frac{1}{2}$ in. The blocks were then assembled in the yokes and held by a $\frac{1}{2}$ in. capscrew, shown in Fig. 5, which had previously been gripped in a collet chuck and had its head turned to a cone which would fit in the hole in the drilling machine table. With the yokes thus assembled the pointed head of the capscrew was located in the hole in the drilling machine table and with a $\frac{33}{64}$-in. drill passed through the hole in the top of the yoke, the second hole in the block was "spotted." After all the holes were thus spotted the blocks were removed and drilled and tapped in the usual manner.

The square cold-rolled stock from which the blocks were made was about 0.002 in. thinner than the 2-in. milled opening between the yokes. The capscrews were $\frac{1}{32}$ in. smaller in diameter than the clearance holes in the jaws so that the asembled universal joints were quite free. Very little stress came on the $\frac{1}{2}$-in. cap-

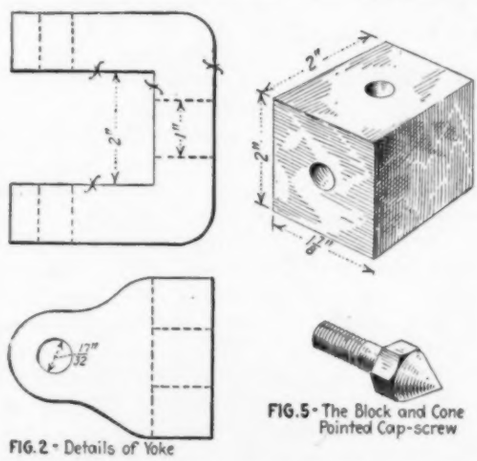


FIG. 2. DETAILS OF YOKE. FIG. 5. BLOCK AND CONE-POINTED CAPSCREW

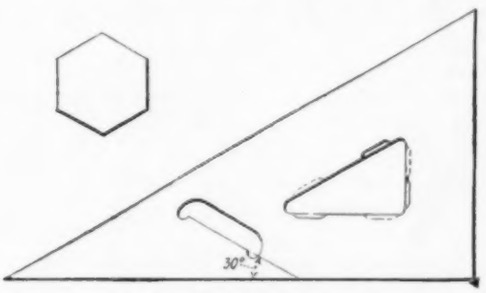
screws finally used to assemble the joints as the square block takes and delivers most of the drive, the capscrews merely keeping the parts from becoming disassembled.

The use of a steel ball in this manner for centering opposite sides of pieces where holes have to be drilled approximately in line is not as widely known as it should be. Some sensitive drilling machines are provided with male and female centers which can de adjusted vertically. Where such is available there is no need to use the ball but there are many drilling machines which are not so equipped and on them the ball can often be used to advantage.

Triangle for Drawing Bolt Heads

BY J. HOMEWOOD

The accompanying drawing shows a 30-60-deg. draftsman's triangle that is cut out to give an additional edge to facilitate the drawing of nuts, bolt heads and other similar parts where it is ordinarily



TRIANGLE WITH AN INSIDE EDGE TO AID IN DRAWING NUTS

necessary to turn the triangle over to complete the figure. This device will be found very convenient for doing small work, such as the hexagon nut head shown, because of the fact that lines slanting 30 deg. in either direction can be drawn without turning over the triangle.

Position of Diamond in Wheel Truing

BY G. G. LITTLE

On page 45 of the *American Machinist*, in the article "Grinding with a Phantom Wheel," the position of the diamond for truing the wheel is in my estimation wrong.

There is but one position in which to place the diamond to insure truing the wheel properly with relation to the movement of the tables of the machine, and that is in a vertical position directly beneath the center of the spindle.

IN THIS ISSUE

THE issue is opened by the first of the McCabe articles on "Economics of Production." There is an introduction by Ernest F. DuBrul, general manager of the National Machine Tool Builders' Association. Our previous announcement stated that there would be ten articles in this series, but it has now been arranged to present everything in seven installments, no one of them longer than two pages. Much of our material for several months has been on economics, directly or indirectly. We recall "Obstacles to Business Revival," by Nathaniel R. Whitney; "The Hard Times—Their Cause and Cure," by Theodore H. Price; "Business Conditions as the Big Banks of the Country See Them" (a weekly article for a long time), and the "Business Barometer" now running each week. They were articles that treated their subjects from an economic viewpoint, but they assumed pre-education in the subject of economics. The McCabe articles, on the other hand, are on the subject of economics itself, treating it in a clear and simple way, yet making it possible for those who wish to do so, to understand the underlying principles of this important science.

Materials handling enters largely into efficient and economic production, particularly in duplicate part work. It is a matter that has too frequently not been given the proper amount of attention. In fact we, ourselves, plead guilty to that charge to some extent. We are going to remedy our deficiency and as a first step are presenting, page 292, an article by Fred H. Colvin on handling materials in an automobile plant. The article shows how elevators and floor openings are used for carrying materials from one floor to the next, describes the continuous assembly arrangement and shows the layout of the plant's four floors. Parts storage and subassemblies also are taken up.

Robert Mawson, page 296, tells how auto-starter frames are machined in the Gray & Davis plant. His article is not hard to read on account of the many illustrations of the special fixtures, devices and clamps that he describes.

There are six pages of the Dowd and Curtis series on tool engineering, beginning with 299, devoted to the design of vise-jaws and vise fixtures and including data on the design of special and swivel jaws for insuring accuracy and quick operation, devices for equalizing pressure, and automatic ejectors.

Equipment and methods in use in the Decatur shops of the Wabash Railroad are described by Hunter in his article on shop work on locomotive cylinder and valve parts, page 305. He tells how saddles of cylinder castings are finished, describes a radial planing attachment for saddles and a portable cylinder boring device, and shows how cylinders are heated for welding.

The article on page 309 by Andrew MacNab explains some novel grinding fixtures. We cannot pick out any particular features to emphasize but assure you that the whole article is of great interest.

The second of Colvin's articles on tools for boring and turning locomotive tires was announced for last week, but lack of space prevented our running it. We managed to crowd it in this week, page 313. The two articles were worked up from the results obtained from inquiries sent to seventeen of the leading American railroads in an effort to secure definite knowledge of present practice in tire boring and turning.

How have selling prices of metals and metal goods compared with the selling prices of other commodities—food, farm products, cloth and clothing, lumber and building materials, etc.? You may feel that they have been very modest, as you remember how much you have been paying for your building materials, your clothing and your food. And you are right. But you need statistics to convince anybody else. If you have a way of presenting your statistics graphically you are still better off. On pages 326 and 327 there is an article, "Fluctuations in Wholesale Prices, 1914-21," which provides a chart that shows the increases and declines of wholesale prices by groups of commodities by months, from early 1914 to late July, 1921, based on an index of 1913 prices equal to 100. There are also shown graphically the price increases and reductions expressed in percentages. We find that not a single industry shows such a consistently low average as that of metals and metal products.

Coming Features

For some time we have been engaged in the preparation of a number of automotive service articles which are to describe the methods, operations and equipment used by several of the largest service stations in the East. The first of these articles will be published within a few weeks. In the meantime they are to be preceded by two articles on cylinder grinding in motor repair shops and one on piston work in motor repairing. The first of the trio will appear next week.

Other articles for the next issue: Organization and Management of the Small Shop (IV); Machining Wrigley Automobile Transmission Gears (III); Incentive or Production Basis of Wage Payment (III); and Economies of Production (II).

EDITORIALS

The Economics of Production

THE present business situation has done much to stimulate thought along economic lines. Not only those at the head of business and manufacturing houses but others all the way down the line are beginning to wonder about the reasons for certain events in the world of trade.

Leaders in all fields of action have emphasized the need for a more thorough understanding of the fundamentals of business or, in other words, the science of economics. We have been keenly aware of the accuracy of their judgment and it is with the earnest hope that we can do something to help the seekers after light that we offer a series of articles under the title, "The Economics of Production."

The articles have been some time in preparation by a professor of economics in one of our large universities, as it was found to be no easy task to reduce so complex a study to the simplest form. The author brings a wide practical and theoretical knowledge to his work and has stated his principles in language that anyone can understand. Don't be frightened away by the word "economics" in the title. A better acquaintance with it will bring confidence and respect.

Let the Buyer Beware

CAVEAT EMPTOR was a timely watch word in old Rome and apparently still is applicable to certain transactions in machine tools. We refer to the practice of a few unscrupulous dealers in second-hand tools who bring an old machine up to date by the simple expedient of adding a digit or two to its serial number. Thus lathe number 168, a veteran of much service, becomes number 1168, a member of a younger and greatly improved series, until the confiding purchaser attempts to buy repair parts for it from its makers.

The automobile "gyp" has been credited with marvelous ingenuity in his many schemes for making an ancient motor car seem what it isn't, but his manipulations seem absurdly complicated when placed beside this simple expedient. Why go to such trouble when bargain hunters are in the market?

The buyer has no one but himself to blame for his gullibility. Were he not so anxious to get something for nothing there would soon be an end to such dealings, as the trickey dealer would starve to death. But unfortunately there are other parties who suffer—the honorable dealers in used tools and the manufacturers. They cannot escape the shadow cast by the crooked dealer although they are not in the least concerned.

The remedy should be a subject for discussion at the meetings of the various trade associations. There is probably no sure cure so long as human nature remains as it is, but it might help in the future to block the serial number at both ends by stars or dashes deeply stamped. This would not prevent the complete removal of the whole serial number but it would make its alteration more difficult. If buyers of machinery would make their purchases of reputable dealers, the problem would require no further attention.

Unwise Taxes on American Traders Resident Abroad

IT IS reported at this writing that a section of the proposed new tax bill outlines a general plan to refrain from taxing American firms doing practically all of their business in foreign countries, except on that portion of their income derived from American resources.

This is probably much too free an interpretation of what those who framed the bill had in mind, and possibly of what the bill actually specifies. It is conceivable that in considering income derived from foreign business the tax experts were attempting to equalize the opportunities of American with those of other traders resident and doing business abroad.

The National Foreign Trade Council makes these statements: "No country, except the United States, taxes its nationals living abroad on income derived from foreign sources. The United States levies income, war profits, and excess profits taxes on its citizens wherever located, and on income derived from all sources."

No one will deny that to properly develop foreign trade America must have American traders living in the foreign trade centers. Isn't it also true that they should be on an equal footing with the nationals of other countries?

Such an argument seems to be enough in itself. But there is a stronger one. The handicapping of American traders with a tax that other nationals do not have to pay will soon put them out of the running and destroy them as a source of income. It is uneconomic.

There's Something Doing

AMONG the glimmers of sunshine which occasionally pierce the gloom come some real rays from three fields, bakers' machinery, paper pulp machinery and cash registers. The first was working overtime, the second about normal and the last almost swamped with orders.

A large dealer who felt pretty blue over the report for May, 1921, had quite a thrill of encouragement when he compared the statement with similar reports for May, 1912, and 1913. The current year was considerably ahead of either. It is difficult to pick the right yard stick for comparing the actual amount of business being done.

Another large dealer reports that releases are being secured on orders which have been held, in some cases for many months. This is particularly true of orders from the automotive field where the manufacturers seem to feel that they must reduce machining costs and be ready for next season's production. Some of these orders are of sufficient size to be interesting, and while the machines have been built for some time, it is an indication of renewed activity and confidence in the future.

Most hopeful of all perhaps, is the report of actual buying of machinery by one mid-western railway. If other railroads will follow suit, buying even a little, builders of heavy machinery can be more cheerful.

Shop Equipment News

Monarch Junior 9- and 11-Inch Engine Lathes

The Monarch Machine Tool Co., Sidney, Ohio, has added to its line of engine lathes a small size, known as the "Junior." It is made in both 9- and 11-in. swing, and in bed lengths from 2½ to 5 ft. It can be furnished in either bench or floor model, as shown in Figs. 1 and 2. As the name of the lathe indicates, it is very much like the larger lathes made by the concern in that it has similar movements and construction.

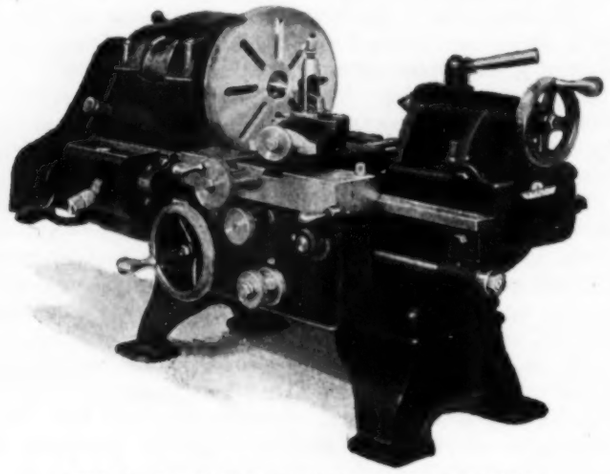


FIG. 1. MONARCH JUNIOR QUICK-CHANGE BENCH LATHE

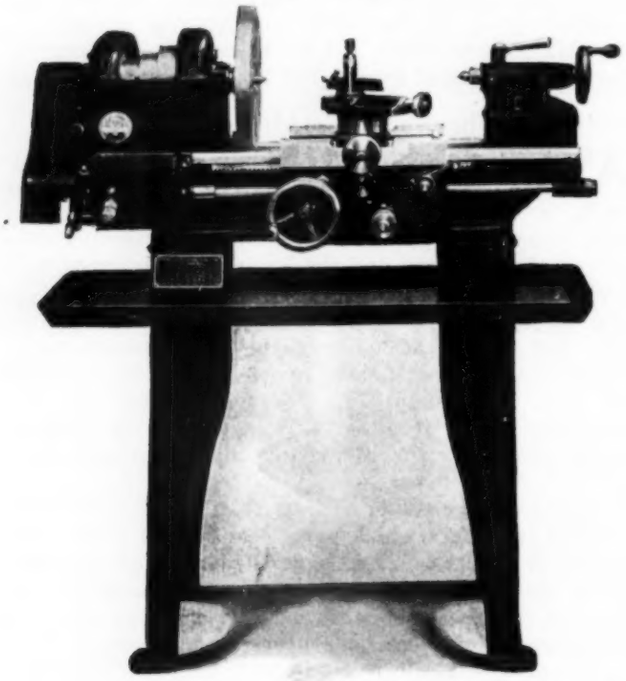


FIG. 2. MONARCH JUNIOR FLOOR LATHE

Specifications: Swing over bed, 9¼ and 11¼ in.; over carriage bridge, 7¾ and 9¾ in. Hole through spindle, 1⅛ in.; taper, No. 2 Morse. Spindle bearings: front, 1⅞ in. diameter by 2¾ in.; rear, 1¾ x 2 in. Back gear ratio, 5.4 to 1. Range of threads per inch: on quick-change lathe, 4 to 60; on semi-quick-change lathe, 4 to 32. Number of thread and feed changes, 54 and 27. Traverse of tailstock spindle, 3 in. Size of tool, ½ x ¾ in. Spindle speeds: number, 6; ranges 27 to 416 r.p.m. Motor required, ½ to ¾ hp. Bed lengths, 2½, 3, 4 and 5 ft. Weight: net, 460 to 565 lb.; crated, 510 to 625 lb.

The headstock is of the bowl type in order to give rigidity, and is equipped with three-step cone pulley and single back gears. Phosphor-bronze bushings are used for the spindle. The countershaft has Edgemont friction clutches and ring-oiled bearings. The bed is made of semi-steel and has cross girts, to give strength. The tailstock has a graduated base, can be set over for taper turning, and can be overhung considerably.

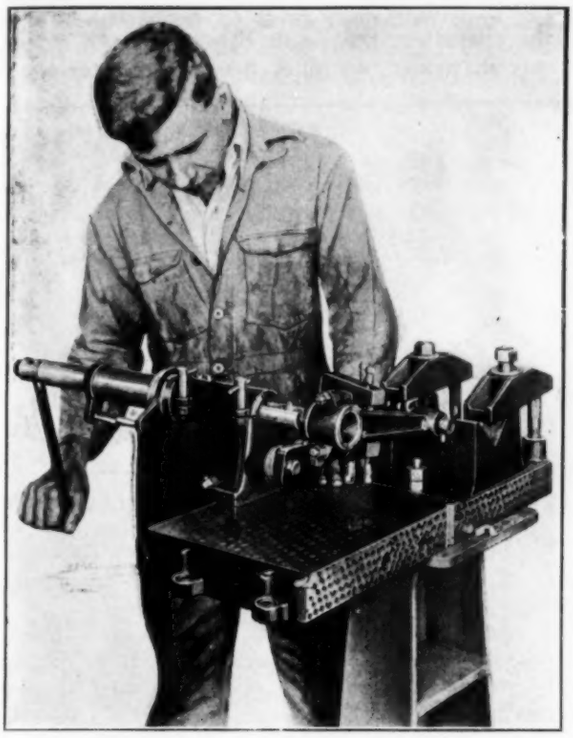
A "Mac-It" screw is employed in the toolpost. Graduated dials are provided on the base and adjustment screws of the compound rest. The carriage is drilled and tapped to receive a taper attachment, chasing dial and chasing stop. Longitudinal and crossfeeds are provided, the apron being so constructed as to prevent the engagement of both simultaneously. The halfnut can be engaged only when both feeds are disengaged.

The machine can be furnished with either full- or semi-quick-change gear box. Fifty-four feeds and threads are obtainable with the former. With the latter three feed changes can be obtained by shifting the change lever and separate change gears can be furnished for cutting any desired thread.

The regular equipment includes countershaft, faceplate, center rest, follow rest, centers and wrenches. Other attachments, such as taper, turret and draw-in and chasing dial and stop can be furnished, no machine work being required to secure them to a machine already in use. An oil pump, settling tank and pan can be furnished. For individual motor drive a countershaft with a belt-tensioning idler can be mounted on the headstock and belted to a constant-speed motor on the back side of the bed.

Weber Connecting-Rod Machine

The machine shown in the accompanying illustration is the Weber connecting-rod machine, which has been placed on the market by the Sawyer-Weber Tool Manufacturing Co., Los Angeles, Cal. The bed of the machine consists of a faceplate on which may be located the clamps, V-blocks, boring tool and other equipment shown in the illustration. It is said that with this machine an operator can babbitt a connecting-rod bearing, straighten the rod and bore the bearing to size. As can be seen, the rod is held by a wristpin through the small end which is clamped in the V-block. The rod is held securely in a support, which has two setscrews in the top for clamping the rod in position. One specially formed cutter is used for the entire operation of boring, facing and filleting. There are two tapped holes in the side of the faceplate, into which a clamp bolt and the stud which serves as a support for the clamp can be screwed, so that a piston can be clamped to the side of the plate and held there for reaming the crosshole. An arm holding a vertical faceplate can also be attached at these holes which makes it possible to test connecting-rod and piston assemblies for straightness. For this operation the wristpin in the small end of the rod is clamped firmly in the two V-blocks and a



WEBER CONNECTING-ROD MACHINE

combination V and parallel block (which is furnished with the machine) is attached to the piston and tested for alignment with the faceplate.

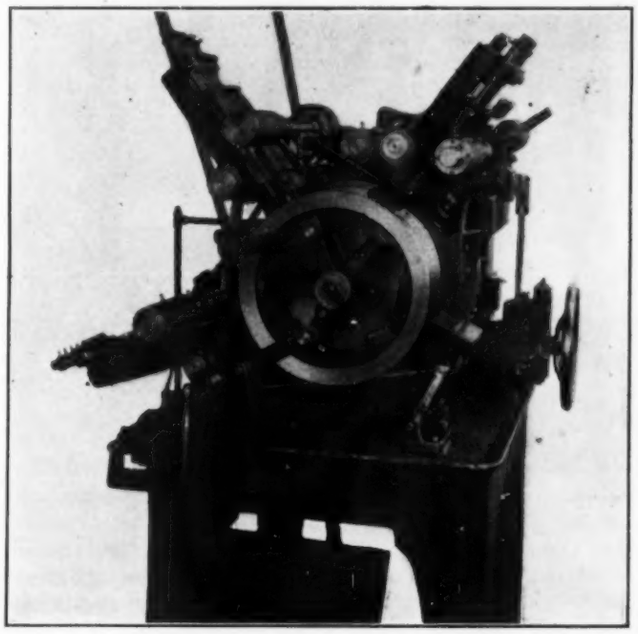
"Automatic" Electric Shop Car

The Automatic Transportation Co., 2933 Main St., Buffalo, N. Y., has developed the automatic electric car shown in the illustration. It is intended to provide quick and convenient inter-shop transportation, and save the time of the busy executive in making inspections and keeping in touch with the various departments of his plant. It can be used for such other purposes as distributing mail and assisting paymasters, timekeepers, watchmen and others in the performance of their duties. The wheelbase of the car is 65 in. and the tread is 35 in. which is calculated to be small enough so that the average factory aisles and doorways will offer no barrier to its progress. The car has a cruising radius of fifty miles on one charge of electricity at a speed of 15 miles per hour, and a load capacity of 500 pounds. It is said that the cost of recharging the batteries is but a few cents per day. A complete charging apparatus is furnished with each car at extra cost.

"AUTOMATIC" ELECTRIC SHOP CAR

Langelier Spoke Nipple Drilling and Tapping Machine

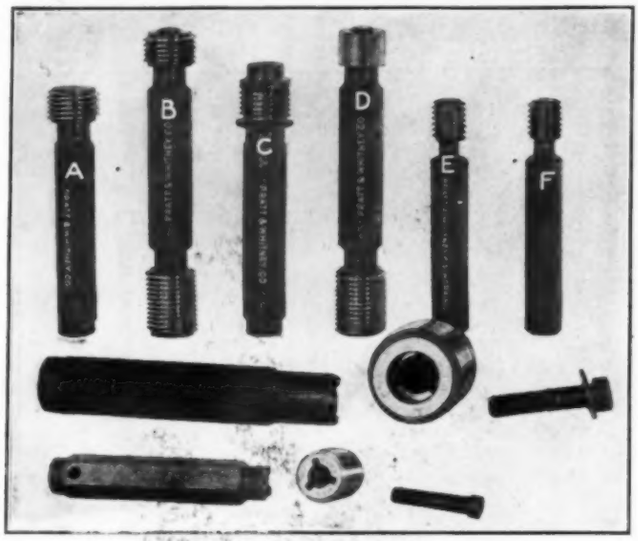
The Langelier Manufacturing Co. of Providence, R. I., has developed a special machine for the rapid drilling and tapping of the spoke-nipples used in the construction of automobile wheels. The nipples are held in lots of five in five different positions on the drum shown in the center of the machine. Corresponding to these five positions are five heads carrying the tools for the different operations. One set of tools centers the nipples, the next set drills them, and so forth. Thus with each movement of the drum, five complete nipples are ejected from the machine. The drill spindles are designed to run about 3,000 r.p.m. Each head is provided with adjustment to compensate for drill wear and grinding. The mechanism which drives the taps includes a reversing clutch fitted with a pneumatic clamping device which drives the taps a few turns into the work, then reverses and partly withdraws them, then sends them forward a turn or two more, and again reverses, continuing this movement, just as a mechanic would manipulate a tap by hand until the thread is run through. The drills are guided by stationary bushings, located close to the surface of the drum, and the bushing holders are fitted with ducts to deliver oil under each bushing directly upon the drill at the point where it enters the work. The machine is almost entirely gear-driven, its high-speed gearing running in oil. The machine is said to deliver 120 finished nipples per minute. It is equipped with automatic stops which suspend its operation if tools are broken or work misplaced.



LANGELIER SPOKE NIPPLE DRILLING AND TAPPING MACHINE

Pratt & Whitney Reversible Thread Plug Gages

The Pratt & Whitney Co., Hartford, Conn., has brought out a line of reversible thread plug gages, made from the same alloy steel blanks as the improved cylindrical plug gages, in all sizes above ½ in. "No Go" and "Go" ends are made interchangeable with the cylindrical plugs and either length can be used according to the customer's preference for long or short threads. The short gages are designed particularly for threads of fine pitch. Rigidity between gage and handle is said to be assured by the use of the tripod support, and the advantage of being able to reverse the gage is obvious. At *A* and *B* in the accompanying photographs are shown the standard type of reversible end gages, single and double end. At *C* is a "Protected Master," so-called from the fact that it is impossible to screw it into a hole and thus destroy its accuracy. It is used as a standard for checking thread plug gages. *D* is a setting plug to be used for setting thread gage templets.



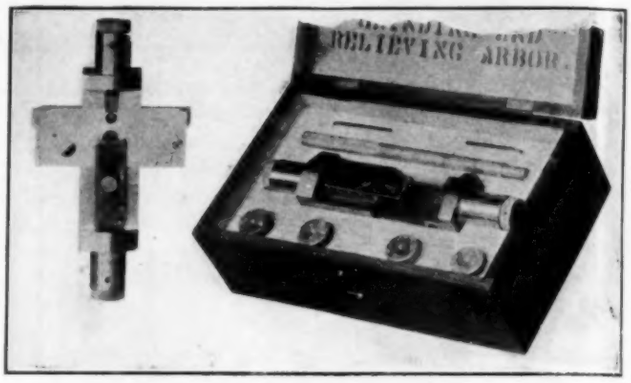
PRATT & WHITNEY REVERSIBLE THREAD PLUG GAGES

The threaded end is made to duplicate the thread in the templet, while the plain end is used for checking the root diameter. *E* and *F* show the non-reversible type of thread plug gage. This style is used for sizes ½ in. and smaller, and for larger sizes where the reversible feature is not desired. The handle is of cold-rolled hexagon steel and the gage end of alloy steel. The two parts are driven together on a slight taper and cannot work loose nor shake.

Kelly Grinding and Relieving Arbor

The Kelly Reamer Co., 3705 W. 73rd St., Cleveland, Ohio, has recently placed on the market the grinding and relieving arbor shown in the accompanying illustration. This arbor is for use in grinding the cutters of "Kelly" reamers. The center bar of the reamer is placed in the arbor as shown at the left and is located centrally by a lug entering a slot on the bar. The arbor is furnished with hardened end plugs, some of which have center holes in the center while others have them both in and off the center.

The arbor is used in a cylindrical grinding machine between centers, where it is oscillated by hand while the grinding wheel is passed across the face of the cutter. Plugs with offset or eccentric center holes are used for the operation, the result being that the cutter is not only sharpened but relieved as well. After one cutter has been sharpened, the cutter bar is taken out of the arbor and reversed so that the other cutter can be ground.



GRINDING AND RELIEVING ARBOR FOR KELLY REAMERS

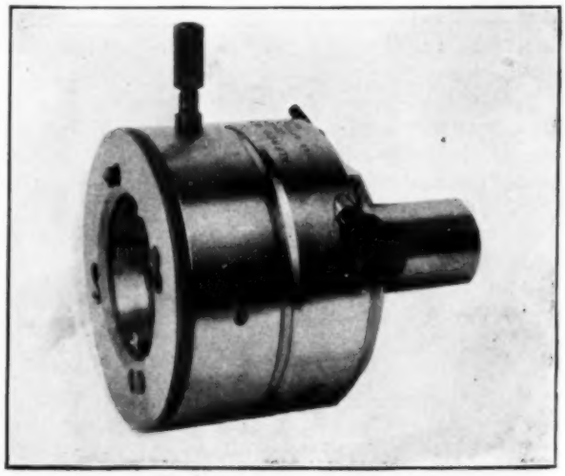
Where cutters are to be ground with a beveled end or lead angle, one end of the arbor should be centrally pivoted while the other end should be pivoted on the extreme offset center.

Alfred Herbert 2½-in. "Coventry" Die Head

The die head shown in the accompanying illustration has been recently brought out by Alfred Herbert, Ltd., Coventry, England, with branch offices at 50 Church St., New York.

The purpose of this die head is to furnish a tool for cutting fine threads that is lighter and cheaper than one of the same nominal size. The action of the die head is the same as the one described in the *American Machinist* April 15, 1920.

Specifications:—Will cut threads on rods from 1¾ to 2½ in. diameter. Will cut threads on pipe from 1½ in. to 2 in., nominal size. Size of die head: Length, 7¼ in.; diameter, 5⅝ in.; diameter of shank, 1¾ in.; length of shank, 3 in. Maximum length threaded using standard shank, 2½ in. Shank is removable, permitting the use of an adapter, allowing the work to pass through it. With this arrangement the length of thread that can be cut is not limited. Weight, 23 pounds.



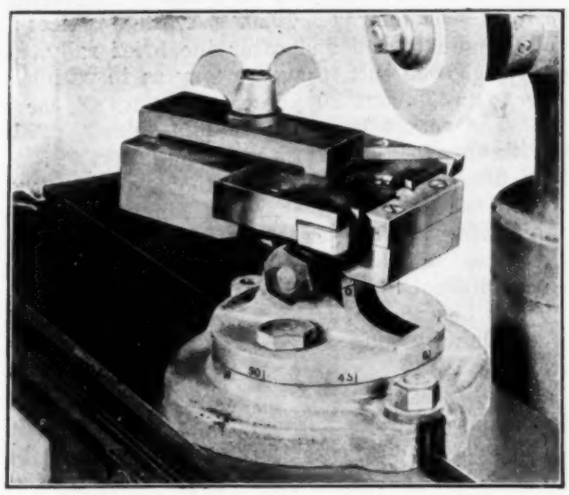
"COVENTRY" 2½-IN. DIE HEAD

Kelly Universal Angle Grinding Fixture

The Kelly Reamer Co., 3705 West 73rd. St., Cleveland, Ohio, has recently placed on the market the universal angle grinding fixture illustrated herewith. The fixture is intended for grinding the nose angles on cutters for "Kelly" reamers, and also for grinding lips in the cutters to give them top rake.

The illustration shows the latter operation, using a formed wheel. For grinding nose angles the fixture is turned approximately 90 deg. in a horizontal plane and a cup wheel used.

The fixture can be completely revolved in a horizontal plane and set to all necessary vertical angles. As in

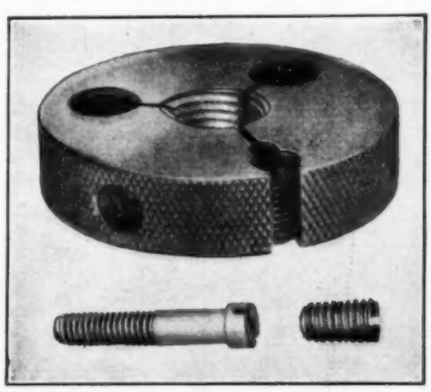


UNIVERSAL ANGLE FIXTURE FOR GRINDING "KELLY" REAMERS

the use of other grinding fixtures for reamers of this type, when one cutter has been ground, the cutter bar is taken out of the fixture and reversed for grinding the opposite cutter. Provision is made for centrally locating the cutter bar in the fixture.

Pratt & Whitney Thread Templet Gages

The Pratt & Whitney Co., Hartford, Conn., has brought out a line of thread templet gages that are of the familiar round adjustable type, but are said to have a distinct improvement in the adjustment. The accompanying photograph shows the assembled gage; also the locking and adjusting screws. The latter is a short tapered screw placed parallel to the axis of the gage. One full turn of this screw changes the effective diameter of the gage about 0.001 in., and adjustments finer than 0.0001 in. are easily made. When the locking screw is tightened, the threads of the taper screw form a perfect dowel in both planes. The gages are made in all sizes from ¼ in. to 5 in. or larger.



PRATT & WHITNEY THREAD TEMPLET GAGES

Pratt & Whitney Improved Plug Gages

A line of improved standard plug gages has been introduced by the Pratt & Whitney Co., Hartford, Conn. The plugs are machine lapped by a modification of the

PRATT & WHITNEY IMPROVED STANDARD PLUG GAGES

Hoke process, which is claimed to produce a finely finished surface entirely free from circular grooves. It is said that the gages are perfectly round and of uniform size from end to end, neither the measuring machine, fluid gage nor amplifying gage showing any errors in these respects. The use of a carefully selected alloy steel, together with this exceptionally good finish, seem to justify the belief that these gages will maintain their accuracy an unusually long time. The "Go" ends are held to a very small *plus* tolerance from the marked size, to allow for wear. The "No Go" ends are held to a still smaller *minus* tolerance, as they are subject to little wear and must accept work which is exactly up to the allowable limit.

A unique and thoroughly efficient method of fastening the ends to the handle is used, which is said to be free from all objectionable features.

The handles are of hexagon stock, giving ample space for marking tool and operation numbers. Three prongs on the handle, of 90-deg. included angle, engage three grooves of 75-deg. included angle in the gage ends. By means of a single screw through the gage, the wedge-like prongs are forced into the grooves, providing a self-centering tripod support. No locking screws, keys or pins are necessary, and the rigidity is said to be practically that of a solid gage. All blanks are well-seasoned before lapping, and the size is marked on the end of the gage instead of on the handle. The range of available sizes is from ⅝ to 2 in.

Fluctuations in Wholesale Prices, 1914-1921

Prices of Metal Products Well Below the Average Price of All Commodities During 70 Per Cent of that Period

THE statistics of wholesale prices issued by the U. S. Department of Labor and reproduced herewith are particularly interesting to those who value the good name of the metal working industry. We are too apt to have our judgment of a man or an industry swayed by a few glaring acts rather than by a calm survey of the situation as a whole. We have heard so much in some quarters about the enormous increases in prices of metal products that it is well to study these charts with considerable care.

Note that prices were considerably below the average at the beginning of 1914 and remained so until almost the middle of 1915. Then the importance of metal goods in carrying on the war, and the enormous demand from all sources, stampeded the market and were responsible for the sudden increase to 257 in the early part of 1917. This increase was only of short duration, however, and the drop to 174 was even more rapid than the rise. And even the peak was modesty itself as compared with those of lumber and building materials, or with cloth and clothing, and housefurnishing goods.

Using the heavily shaded line as a basis, this being the average of all commodities, those who are in metal working industries might almost assume a holier-than-thou attitude without fear of a come-back. For as can be seen the price line dropped below the average at a time when nearly everything else was climbing skyward at a rapid rate.

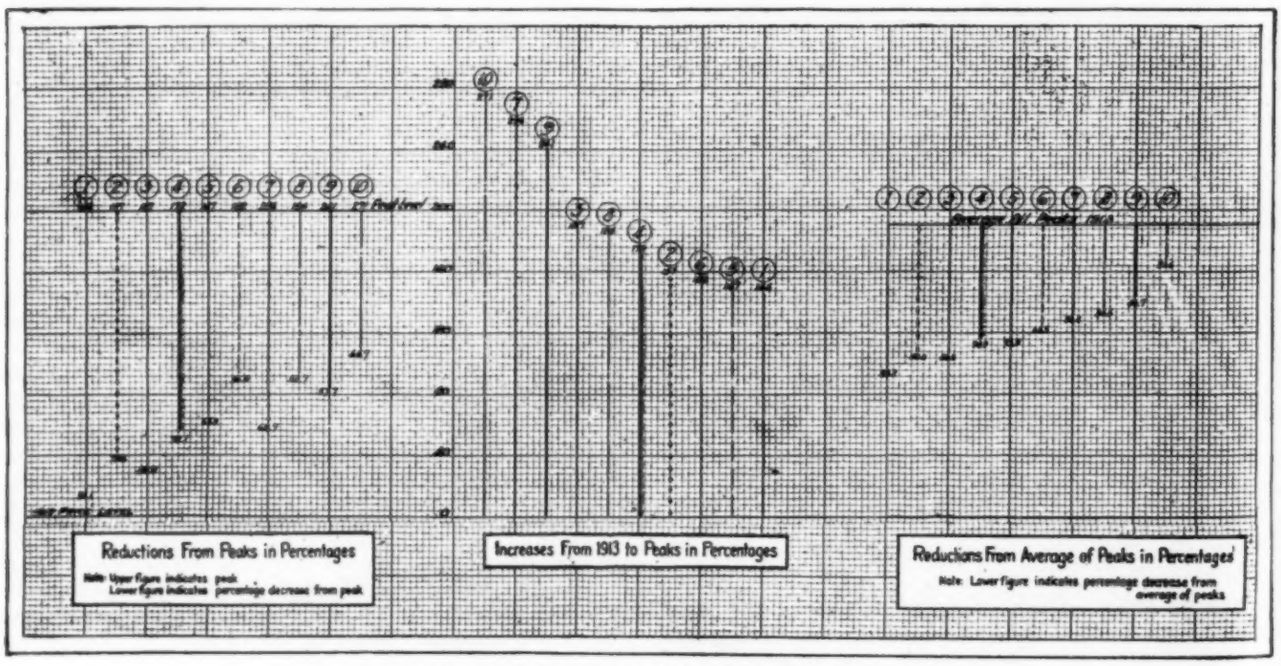
Dropping about 6 points below the average it followed the curve of average prices very closely all through 1918, with the difference becoming larger as the months went by. Starting with 8 points below the average in January, 1918, it was 19 points below in the spring of 1919. And while that was the low point for average prices for considerably over a year, metals and metal products kept dropping until they reached 152 in the early summer of 1919. In the meantime average prices had been soaring steadily once more with the exception of one break in the fall of 1919, and reached their peak of 272 in the early spring of 1920.

Metal products recovered to some extent, getting as high as 194, then breaking and again recovering to 193 in the summer of 1920. Average prices had already begun to fall and after the brief rally, metal products followed suit in such a way as to paralliel the average curve, about 20 points below it, all the way down. The report leaves it, in midsummer, 1921, at 134, with only food and farm products lower.

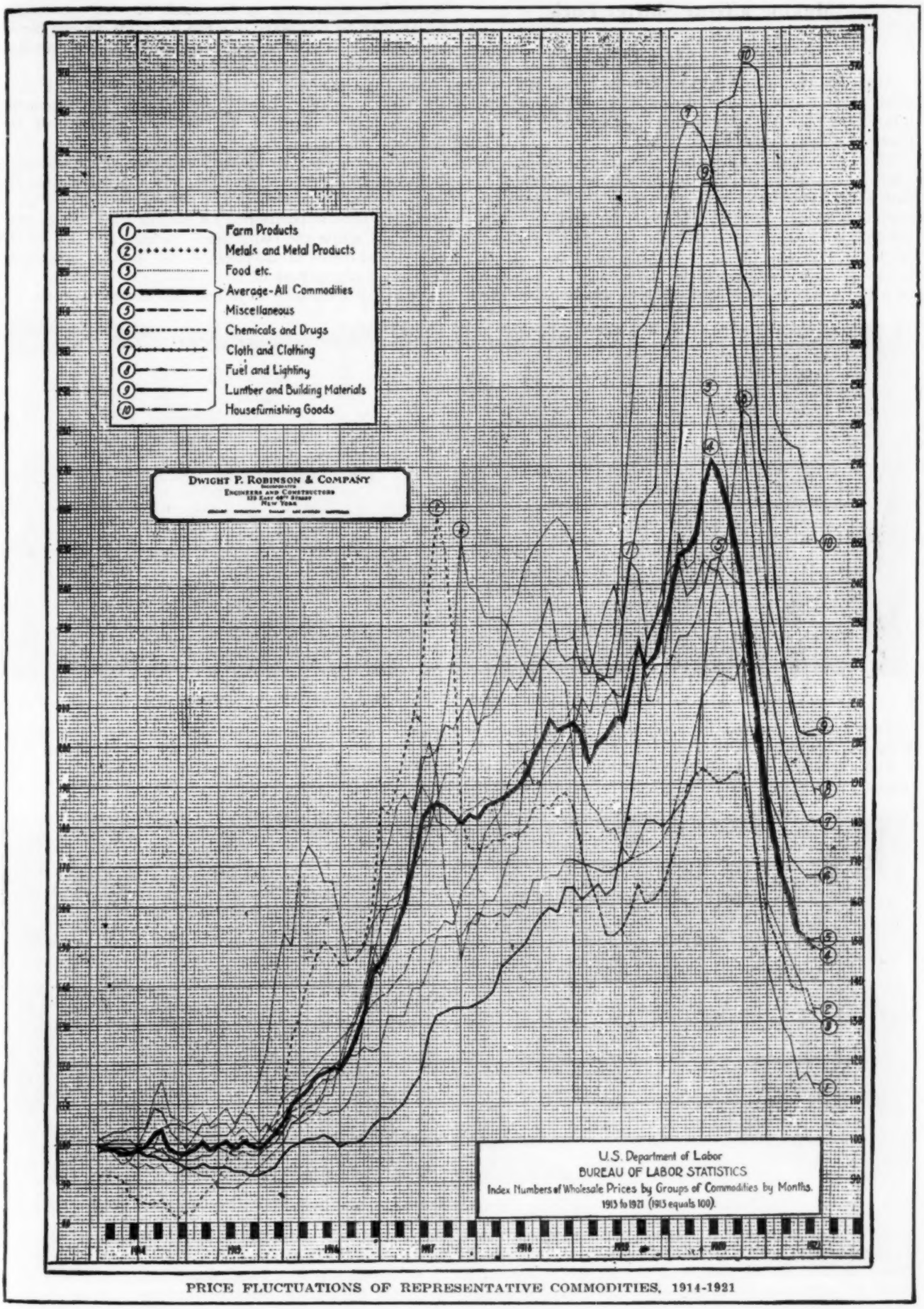
This diagram also shows us that we have rather maligned the farmer in charging him with the high cost of living. It will be seen that he lagged behind even the modest metal working industry and that farm products did not reach their peak until the latter half of 1919, when they touched 246. Other food products kept on, however, up to the 287 mark about a year later.

Not a single industry, however, shows such a consistently low average as metals and metal products. Except for the flurry in 1917, it has been well below the price average, a fact made particularly noticeable by the large area between the metals curve and the curve of average from the beginning of 1918 to the end of 1920, three long, strenuous years.

The manufacturers of housefurnishing goods, of electrical and gas machinery, of cloth and clothing, and a few other industries certainly have no excuse for longer refraining from purchasing the machinery they require for economical production. They can hardly claim to be waiting for lower prices of machines when these are already so far below their own in the index scale.


Reductions From Peaks in Percentages
Increases From 1913 to Peaks in Percentages
Reductions From Average of Peaks in Percentages

INCREASES AND REDUCTIONS IN PERCENTAGES


1 Farm Products
2 Metals and Metal Products
3 Food etc.
4 Average-All Commodities
5 Miscellaneous
6 Chemicals and Drugs
7 Cloth and Clothing
8 Fuel and Lighting
9 Lumber and Building Materials
10 Housefurnishing Goods
DWIGHT P. ROBINSON & COMPANY
ENGINEERS AND CONSTRUCTORS
U.S. Department of Labor
BUREAU OF LABOR STATISTICS
Index Numbers of Wholesale Prices by Groups of Commodities by Months.
1913 to 1921 (1913 equals 100).

PRICE FLUCTUATIONS OF REPRESENTATIVE COMMODITIES, 1914-1921

Making a Gear Shifter Fork

By FRED H. COLVIN
Editor, *American Machinist*

Although the gear shifter fork is a comparatively small part of a motor-car transmission, there are many interesting operations in its makeup, some of which are illustrated herewith.

The first step is annealing the drop forging, after which the piece is drilled, rough-reamed and faced on both ends. Then comes the turning of the barrel in the engine lathe, as shown in Fig. 1, a mandrel being used for this purpose. The shifter fork has a flattened projection which fits into the box-shaped driver *A*, this being screwed to the faceplate. The work is being done on a Porter-Cable lathe having a feed knockout as shown in front of the carriage. The shape of the projection or wing which drives the fork can be seen in Fig. 2.

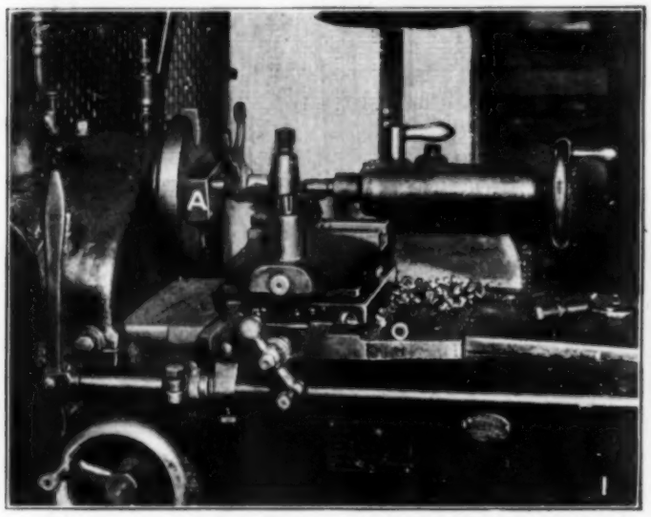


FIG. 1. TURNING THE BARREL.

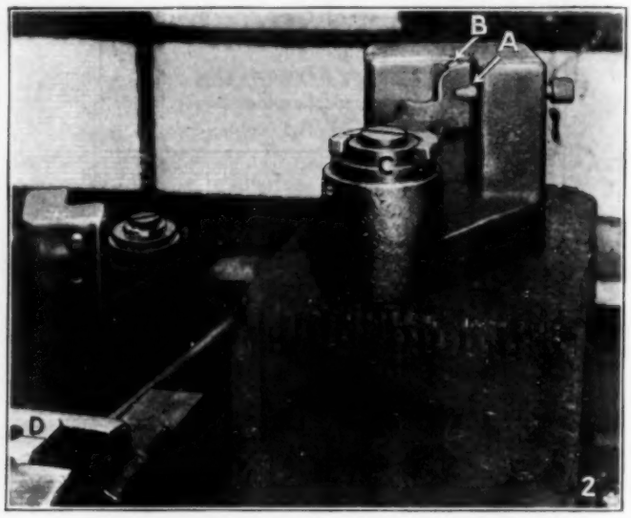


FIG. 2. HAND STRAIGHTENING

The forks are then aligned by striking in a power press, after which the hole is finish-reamed, and the piece hand-straightened if necessary. The gage for this is shown in Fig. 2, the notch on the wing of the fork being located by the hardened pin *A*, while the wing itself is positioned by the pin *B*. The forked ends are tested for squareness on the block *C*. Any correction which may be necessary is made by clamping the barrel of the fork in the special vise jaws *D* and making the necessary correction with a hammer.

The forks are then straddle-milled as shown in Fig. 3, the fork *A* being clamped in the block *B* and supported by the post *C* against the downward thrust of the milling cutters.

The wing is then straddle-milled, after which the tooth is milled in its correct position, and the three slots for the locking pins milled in the fixture shown in Fig. 4. Here the fork is positioned by having the ends go over the pin *A* while the rod *B* goes through the hole in the barrel and holds it in position, as well as supporting it against the thrust of the milling cutters.

Then the clearance is milled for the other fork, the piece carbonized, heat-treated and drawn to the desired temperature. The scale is then lapped from the hole, the fork straightened and hardened in lead. The fork is then carefully checked up, again straightened if necessary, clearance ground between forks and on the pads completing the operations.

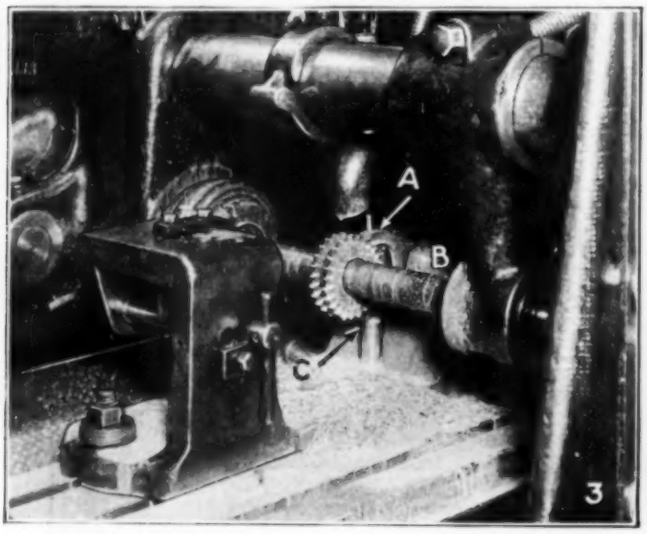


FIG. 3. STRADDLE-MILLING THE FORKS.

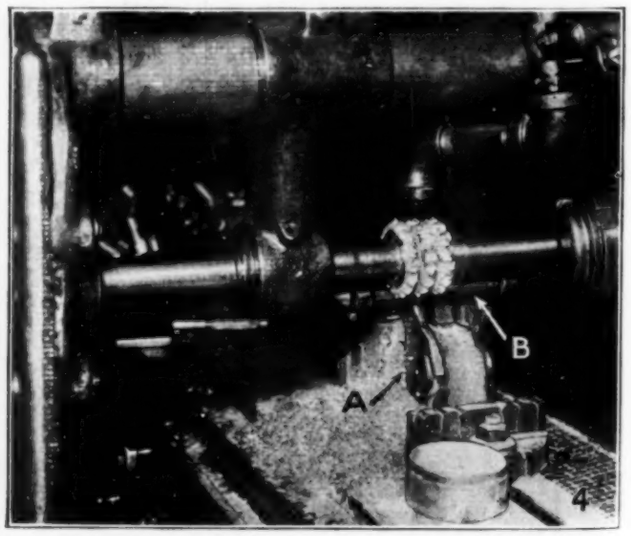
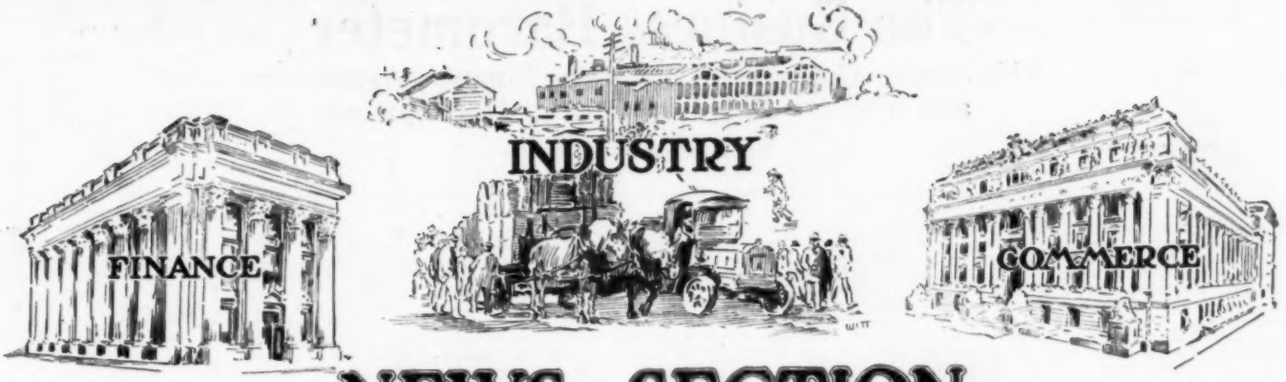


FIG. 4. MILLING THE THREE SLOTS FOR THE LOCKING PINS

Although this is a small detail it is one which plays an important part in the safe handling of a car.



NEWS SECTION

International Cost Conference Program

The final program of the Second International Cost Conference to be held under the auspices of the National Association of Cost Accountants, at Cleveland, on September 14, 15 and 16, has just been issued. Among the subjects which will be dealt with at the different sessions are: Executive uses of a cost system; the distribution of overhead under abnormal conditions; cost systems as a means of preventing waste; uniform methods and standardized costs.

Most of the railroads have granted reduced fares under the certificate plan for this conference, and it is expected that the largest and most representative gathering of cost men which has ever assembled in this country will meet in Cleveland.

The national headquarters of the association are located in the Bush Terminal Sales Building, 130 West 42d St., New York City.

Government Investigating Trade Associations

An official statement having to do with the activities of trade associations will be issued the latter part of August. A promise to this effect was made by Commerce Secretary Hoover after a conference on the subject between Mr. Hoover and members of his staff with the Attorney General and members of the Department of Justice staff. Pending the issuance of the statement, Mr. Hoover declines to comment. The Attorney General stated that there are a great number of trade associations which are of much benefit to business and that the activities of the great majority of these organizations are not being questioned. He said the Department of Justice simply is trying to find if there are not some cases in which illegal activities are being carried forward under the guise of trade associations.

The probabilities are that the official statement which is to be issued will not go very far toward illuminating the twilight zone which covers a part of the field of some of the existing associations. Since the Supreme Court of the United States is expected to hand down, during the October term, an opinion in the hardwood lumber case, which may define some of the limits of the fields of the trade associations, it is not probable that any executive department is going to declare any very definite policy before the rendition of that opinion.

The Department of Commerce has ascertained that there are more than 5,800 trade and industrial organizations in the country.

Urges Publication of Engineering Data

Professor Arthur M. Greene, Jr., new dean of the Princeton College of Engineering and chairman of the research committee of the American Society of Mechanical Engineers, urges the need for research in an address to the engineering profession, through the official journal of the society. He points out that surprising facts, for instance, have been revealed by the report of the committee on elimination of waste in industry, of the American Engineering Council, organized by Herbert Hoover. Mechanical engineers should be willing to give their data to the profession after they have used them for development work, says Professor Greene. "Many data," he says, "are buried where they are doing no work, and their publication would not damage our business and would help the profession."

Brazil to Provide Water Storage for Semi-Arid States

In connection with its plans for the reclamation of its semi-arid States the Brazilian Federal Government has retained Dwight P. Robinson & Co., Inc., of New York, to supervise a large amount of engineering and construction work. This work, which is located in the states of Ceara and Parahyba, will include the construction of five large dams—involving nearly a million cubic yards of concrete—to create storage reservoirs, some of which are to be larger than any artificial reservoirs existing elsewhere.

The work is to be conducted under the direction of the Brazilian Government, and in its ultimate importance and economic value it is comparable to the irrigation work carried on since 1903 by the United States Government.

In these semi-arid states of Brazil there is an average rainfall of about 30 in., which if properly distributed as to time and volume would make, even under the tropical sun, a sufficient supply of moisture to produce moderate crops. The climate, however, consists of a dry season extending from May to December and a rainy season lasting from January to April or thereabouts. Practically all of the rainfall occurs during the rainy-season months when, if the precipitation falls in heavy rains, the soil is saturated, the springs are renewed and the rivers are in flood. In the dry years, however, the rainfall, although aggregating as much as the average year, may be precipitated largely in thin showers which, under a tropical sun, are quickly evaporated, with the result that the soil does not become well moistened and the rivers carry little if any run-off. Severe droughts result which reduce the inhabitants of this section to a condition of starvation. It is to remedy this situation that this reclamation program has been undertaken.

The region to be benefited, lying in latitude 4 to 8° south of the equator, will have climatic possibilities similar to southern Arizona and California or the irrigated section of the west coast of Mexico. The streams which drain the region are of large volume and will furnish ample supply for reservoirs. The products of the country include cotton, sugar, skins, medicinal products, various kinds of palm and other nuts for the production of vegetable oils, citrous fruits and other products of tropical and sub-tropical agriculture.

The work is under the direct control of the Inspectoria de Obras Contra as Seccas, which is a department of the Ministry of Viacao e Obras Publicas. The Inspector General in charge of the work is Dr. Miguel Arrojado Lisboa; Dr. Pires do Rio is the Minister of Viacao e Obras Publicas.

The initiation of active work at the present time is due in large measure to the interest shown by the president, Dr. Epitacio Pessoa, who has given this program for the material betterment of a needy section of his country the same support which Theodore Roosevelt gave the Reclamation Service in the United States.

Remington Salesmen Convene

Eleven southeastern sales managers of the Remington Arms Co., of New York, held a three-day conference in Atlanta the second week in August, discussing general business conditions and mapping out the sales campaign for the coming year. Similar group meetings are to be held in New Orleans, Dallas, Oklahoma City and Kansas City.

Paris Aeronautic Exposition in November

The Seventh International Aeronautic Exposition will be held at Paris on November 12 to 27, 1921, according to a recent communication from the office of the American consul general at that city. Exhibitors are welcome from any country not having been at war with France. This exposition is not confined to flying machines and motors, but will include sections devoted to aerial navigation companies, motor boats, gliders, machine tools, marine motors, electrical apparatus, spare parts, and industrial materials, relating to the aeronautic industry. Applications of exhibitors for admission must be received by September 1, 1921. Blanks may be procured from the European Division, Bureau of Foreign and Domestic Commerce, or from the bureau's district office, 734 Customhouse, New York, upon reference to file No. 33549a.

Detroit Police Arrest Tool Steel Robbers

With the arrest of five Detroit men last week the police of that city believe that they have caught some of the members of what they believe to be an organized ring of steel robbers which has been operating in Detroit, Cleveland and Toledo for the last nine or ten months. Tool steel to the value of several hundred thousand dollars has been stolen by members of this ring, the police say.

The detectives say that confessions by two of the prisoners show that the stolen metal was sold by Detroit brokers at much less than the market price. An elaborate system, whereby the crooks even had their confederates tamper with the accounts of the firms from which the steel was stolen, was also discovered.

Stolen steel valued at more than $5,000 was discovered in a yard in Detroit.

The men under arrest include Hyman Kramer, William N. Burroughs, superintendent of the Union Drawn Steel Company's yards at Detroit; Albert Langer, superintendent of the railroad yards at several Detroit plants, and Earl Miller, head of a large Detroit trucking concern. The fifth man, Benjamin Cohen, head of the Cohen-Kunzky Scrap Iron Corporation of Detroit escaped.

Bureau of Mines to Study Coke Properties

G. St. J. Perrott, associate physical chemist of the United States Bureau of Mines Experiment Station, Pittsburgh, Pa., is to be sent to Birmingham, Ala., to study the physical properties of coke in relation to its production and use in the blast furnace. Blast-furnace operators declare that there is a decided lack of knowledge regarding the physical and chemical properties of coke in producing iron ore. In the stress of wartime they found it necessary to use almost anything in the way of coke material that was offered, and, it is said, they found they could use materials that before seemed impossible. It is believed, therefore, that the investigation proposed offers a very fertile field for the obtaining of very important information. Conditions are very favorable for the conducting of these investigations at the Tuscaloosa Experiment Station of the Bureau of Mines, where there are quite a number of small blast-furnace plants and by-product plants, many of which are ready to carry on investigating work.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, *Commerce and Finance*, New York
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Despite the aloofness of some Americans the drama now being enacted on the world's stage includes all humanity and to be understood it must be seen in its entirety. Interest this week has shifted to Europe. The Irish atmosphere is again cloudy and while there is reason to hope that De Valera may not mean all he says and that the ancient feud may yet be settled, it is plain that the English people will not permit Ireland to secede and it is possible that Great Britain may find herself involved in a long and internecine conflict as a result of her determination to preserve the "United" Kingdom.

That she will succeed in maintaining the solidarity of the British Empire even though she may have to face a struggle so deplorable there can be no doubt, but the pity of it and its possible effect upon her dominions overseas must give pause to the thoughtful observer. In distant India the rumblings of unrest are distinctly audible, in Australia the demand for an Imperial parliament in which the Antipodean commonwealth shall be represented is daily becoming more vocal, and in the relations of Great Britain with several other nations of the Eastern hemisphere lesions are threatened that may severely tax the remedial skill of Lloyd George, who continues to amaze the world by his political dexterity. His latest appeal for a triple alliance between Great Britain, Japan and the United States is probably inspired by a recognition of these involvements and their implications. The wonder is that he can stand the strain. So long as he can maintain himself and his coalition cabinet he will probably be able to compose the situation; but a less tactful and more autocratic leader might find it difficult to deal with.

Realizing the complexities of the outlook, the English markets have been a little less confident in tone during the week and exportable American staples such as cotton and wheat have shown a reactionary tendency.

German Finances

Another and a curious consequence of the parlous conditions that exist in Europe is to be observed in Germany where the Berlin stock exchange suspended operations for two days because it was overwhelmed with buying orders inspired by a desire to exchange the rapidly depreciating paper mark for securities supposed to have a permanent and intrinsic value. As a result of this eagerness to exchange marks for something else they have fluctuated wildly. On Tuesday they declined to 1.06¾, recovering to 1.22 on Thursday.

At a cent apiece $10,000 will buy a million marks worth $240,000 at their par value in gold. Attracted by such long odds a great many fatuous people in this country are taking the gamble and it is not impossible that a large share of the German reparation fund will be raised by the simple expedient of running the Berlin printing presses and selling their paper output. A banker who has studied the facts closely told me that he was disposed to believe that in one form or another Americans now owned one fourth of the outstanding German circulation, which, according to the last statement of the Reichsbank, amounted to 77,300,000,000 marks. This does not include the "Darlehnskassenschein" notes issued by the German treasury which amount to about 15,000,000,000 marks. Against both these issues there is held only 1,091,500,000 marks in gold.

Certainly the ease and promptitude with which Germany is now making the reparation payments agreed upon is surprising and the joke would be on us if it should turn out that she is exchanging 100 paper marks which cost her little or nothing for a dollar in good American money.

But whatever the facts it seems unlikely that Germany can continue to conduct her business with such a preposterously inflated currency and when deflation comes as come it must the demonetization of paper in Germany with the speculative collapse that will inevitably follow may be acutely felt in France and Italy where the circulating medium consists entirely of bank notes that are practically irredeemable.

Elsewhere in Europe the week has brought no striking developments. American relief for famine stricken Russia has been delayed by Soviet insistence upon supervising its administration. This Mr. Hoover has quite properly refused to permit. The Russians thereupon waived their demand and the machinery of food distribution has been finally set in motion. The released American prisoners now coming out of Russia report that the country is politically unconscious and an economic and social wreck. The war between Greece and Turkey is still in progress though our papers hardly mention it and most Americans are unaware of it.

In Mexico the insurgent element is trying to organize another revolution against Obregon, whose revenues have been seriously reduced because the export tax on oil has practically stopped its production. In Cuba the financial crisis is being slowly relieved as sugar is sold, but recovery is slow. Incidentally, raw and refined sugar are about 30 points lower in the American markets.

I have given first place to a review of foreign conditions this week because there is really little that is new to report in regard to affairs at home. Things are slowly but steadily improving here but the speculative spirit is still lacking and the demand is for the necessary rather than the superfluous. If we are, as some believe, sufficiently self contained to be unaffected by the reaction which will attend upon European deflation, we have nothing but our own fears to make us afraid. For a more elaborate exposition of this view I take the liberty of referring to an article entitled "Can We Be Prosperous Without the Aid of Europe?" written by me and published in the *American Magazine* for September.

Briefly, there is some improvement in the demand for iron, steel and copper. Coal is also being more freely bought though the winter's requirements are still very poorly provided for.

Continued impairment in the condition of the cotton crop is reported and the market would have been higher if conditions abroad had been less discouraging. The textile markets are steady and the turnover good. Railway revenues and traffic continue to pick up but railway securities are still sluggish in the stock market as a result of Congressional hesitation in authorizing the War Finance Corporation to advance the five hundred millions that the President and Eugene Meyer are anxious the roads should have, because they believe it would stabilize financial conditions, start the wheels of industry moving and bring about the re-employment of the unemployed.

The unemployment is, however, probably exaggerated. Based on returns from industrial establishments and other organized employers of labor the Department of Labor estimates that 5,735,000 persons were out of work in July, but these figures take no account of the fact that many who were formerly employed in factories and cities are now at work upon the farms.

Although the railroad men defend it, the Interstate Commerce Commission has not enhanced its popularity by refusing to allow Mr. Ford to reduce rates on his railroad because the "rate structure" would thereby be disturbed. People think it strange that it is easy to get rates up and so hard to get them down.

Meantime a demand for lower freight and passenger rates is being heard from all over the country. It is daily becoming louder and unless the railroads and the commission heed it the President and Congress may be forced to act as Election Day comes nearer. Hope deferred maketh the heart sick and while small favors are thankfully received the reduction in taxes promised in the bill now before the House has not been greeted with great hilarity. The public mind has been somewhat indurated by unfulfilled promises of financial relief and most taxpayers are now like the man from Missouri. For them, seeing is believing.

Reserve Ratio Gaining

The most definitely stimulating news of the week is to be found in the statement of the Federal Reserve System. The reserve ratio has advanced from 65 to 65.8 per cent and the supply of gold shows a further gain of $24,300,000. It now stands at $2,600,000,000 as against $1,966,000,000 a year ago. This increase of $634,000,000 is about one and a half times the world's gold production in the same period.

Unless those who frame and control the policy of the Federal Reserve Banks are determined to deny the American people the reduction in the cost of credit to which this abundant gold supply entitles them, we shall have much easier money market soon with the increase of business activity that always follows when enterprise can obtain the capital upon which development depends.

That the well informed are confident that a decline in interest rates is not far off is shown by the gradual advance in Liberty Bonds, the hardening market for other interest bearing obligations and the ease with which new issues can be floated. An advancing bond market has always been the precursor of a broader activity in business and there is every reason to believe that his rule holds good.

With lower interest rates, cheaper railway rates and some real reduction in the tax burden, a return of genuine prosperity would not be long delayed.

	End of Last Week	End of Previous Week	Last Year
Bank Clearings (Bradstreets)			
In thousands	$5,809,905	$5,771,386	$7,574,459
Business failures	376	329	139
Security price, N. Y. Stock Exchange:			
20 Industrials	65.96	66.42	85.31
20 Railroads	72.28	71.30	73.90
40 Bonds	77.62	77.66	73.80
Commodity Prices:			
Wheat, No. 1 spring	$1.59½	$1.66	$2.80
Corn, No. 2 yellow	.73½	.77	1.77½
Beef, good dressed steers	15.25	16.25	23.50
Pork, mess, bbl	26.00	24.50	32.50
Sugar, refined	.0615	.0615	.1710
Coffee, Rio No. 7	.07⅜	.06½	.08½
Cotton, middling	.1300	.1325	.3350
Print cloths	.04½	.04½	.12½
Wool, domestic average	.4173	.4173	.....
Silk, No. 1, Sinshiu	5.70	5.75	5.60
Rubber, crude, plan	.14	.14	.32½
Hides, pack. No. 1	.14	.14	.28
Iron, No. 2, Phila	20.34	19.84	49.50
Steel billets	30.00	30.00	60.00

Publications Desired by Amsterdam C. of C.

The Netherlands-American Chamber of Commerce at Amsterdam will be pleased to receive books and literature concerning the United States, together with periodicals and artistic advertising posters of American firms, states a recent communication from J. W. Vander Laan, secretary to the American commercial attaché at The Hague. All material should be addressed to E. H Von Baumhauer, secretary of the Netherlands-American Chamber of Commerce, Damrak 83, Amsterdam, the Netherlands.

Resolutions Passed by International Chamber

Among the resolutions adopted at the recent London meeting of the International Chamber of Commerce was one which declared that "government control of or participation in industry and commerce discourages individual initiative and renders trade conditions uncertain and artificial." The resolution further set forth that government control of industry and commerce should be discouraged and private enterprise encouraged in all lines of industry and commerce.

This resolution, with seven others, was introduced in the sessions of the production group, and was adopted by the whole congress. The other group sessions—Distribution, Transportation and Communication, Finance, and Devasted Areas—also contributed resolutions for the congress to act upon. In all, twenty-nine resolutions were approved by the congress, all of which have been made public by the American section of the International Chamber.

Means of effecting economies as well as increasing production were discussed at the production group sessions. This was true especially of fuel, the production group declaring that "in addition to the measures taken to increase the production of fuel it seems no less necessary to make every effort to make the best use of the coal at our disposal."

The congress recommended that in countries which have not yet an organization studying the question of the economy of fuel, such an organization be created for this purpose; and that the International Chamber get into touch with the different national organizations with a view to coordinating and diffusing the results of their work.

Economy in raw material also was urged in a resolution which pointed out that "the conservation of some of the world's natural resources is of paramount importance to the welfare of the world for the reason of the rapidly diminishing supply." It was urged that the International Chamber take immediate steps to encourage research work and investigations in every possible way to lessen the waste in the production and utilization of raw materials, and to make available the results of such researches and investigations.

In accord with the view of the American delegation, the production group went on record in favor of standardization, holding that "standardization is of paramount interest from the standpoint of international commercial relations." The resolution adopted on this subject urged that in countries where there does not yet exist a standardization organization, such an organization be created for the purpose of studying this subject.

It was recommended by the congress that within the International Chamber there be created industrial sections which will enable qualified representatives of each category of industrial or business men to get into touch with each other and discuss questions of international interest; that the International Chamber get into touch with already existing permanent international federations or bureaus, such as construction, motor industry, cotton, production of books, in order to co-ordinate the result of their work.

The abolition of export taxes on raw materials was advocated. The resolution on this subject made plain the fact that every tax on export of raw materials must necessarily increase the cost of production and thereby hinder economic development and prevent economic restoration. It also stressed the point that "it is desirable to put a stop to, as far as possible, the rivalries between nations in their search for raw materials, to stamp out the cause of economic conflicts which may threaten peace, and to do away with the natural inequality arising from the fact that the riches of the world are unequally spread over its surface and to assure the rapid restoration of the world's commerce."

The resolution suggested that the following raw materials be free from an export tax: Untanned hides, skins and furs, wool in bulk or wool skins, raw horsehair, etc., silk in cocoon, raw silk, floss silk or silk in bulk, raw materials for fertilizers, gum in a raw state, Indian rubber, gutta percha, unprepared timber, raw cork, raw cotton, flax, hemp, jute and other vegetable fibers in a raw state, ores and mineral products, natural metals, precious metals (gold, platinum, silver, etc.), mercury, filings and waste of metals, stone and earth employed in construction and different industries, etc., coal, mineral oils, and oleaginous grains and fruits not used as food, in their imported state.

Another resolution urged that the International Chamber appoint a permanent committee to undertake a world survey of the construction industry and provide a necessary staff for carrying on such work.

This survey would proceed along the lines of collecting and collating and discriminating the vast amount of valuable data which is available and which is at present in the possession of such agencies as the British Societies of Engineering Standards, the Royal Institute of British Architects, the French Ministry of Commerce, the Office de Batiment in Paris, the International Biographical Institute of Brussels, the Advisory Committee of the Federation of Labor, the National Federation of Construction Industries of the United States, the Associated General Contractors of America and a number of similar agencies operating in different countries.

The question of statistics was brought before the congress in a resolution which stated that increased and cheaper production is essential in the re-establishment of the economic balance of the world, and will follow a sustained normal demand as soon as this can be arrived at. The resolution urged that steps be taken to bring about as soon as possible the creation of an international bureau of statistics which will make promptly available exact and readily comparable data of paramount significance of the commerce of the world.

Specifications on Pumps and Motors for South Africa

Blueprints and specifications covering the contract for the supply and erection at Vereeniging, Transvaal Province, South Africa, of two vertical and two horizontal spindle centrifugal pumps and motors, with all accessories, and one 10-ton traveling crane have been received by the Bureau of Foreign and Domestic Commerce from Consul Fred D. Fisher, of Johannesburg. This material is for use in connection with the Vaal River scheme. The specifications may be examined by interested persons at the bureau's New York office, 734 Customhouse, or will be made available at any other district or co-operative office upon request. Refer to file No. 33 592

Steel Prices Advanced

Indication that prices for iron and steel have reached the lowest point compatible with present costs of production was seen in the reported action of the Inland Steel Co. in raising the price, in spite of a lack of demand, for a certain grade of iron on the ground that any lower price results in a loss to the company. The company is said to have the only foundry furnace now in operation in Chicago district, is reported to have advanced price of foundry iron from $18.50 to $20 a ton. This situation is in harmony with statements of the Federal Reserve Board and other responsible agencies that wholesale prices generally have reached the lowest levels that can be maintained under present conditions. As one Federal Reserve official puts it: "The cycle of deflation is about completed."

Mexico Buys Baldwin Locomotives on Credit

Samuel M. Vauclain, president of the Baldwin Locomotive Works, Philadelphia, Pa., who has returned from Mexico City, where he conferred with President Obregon, announced he has arranged for a credit of $2,500,000 to that government for the purchase of locomotives and had given the Mexican government the privilege of an additional credit of $2,500,000. Under the first credit Mexico ordered 45 locomotives and 20 under a separate condition of payment.

Low Iron Production in South

The lowest record for pig iron production in Alabama for many years was made during July, when only 66,573 tons were reported. This was produced with five furnaces in operation. The June report was 93,224 tons, produced with eight furnaces in operation, and this was the previous low record in many years. There was no product at all in Georgia and Tennessee during July, for there were no stacks operating in those states at all, the five in Alabama being the only ones in the iron-producing states of the South.

August started off with two blast furnaces operating in Alabama, on foundry iron, and four on basic with the probability that there will be at least two more furnaces running before the end of the month because of the steady improvement the past few weeks in conditions in the metal trades industries.

Bureau of Standards on Fuel Economy of Automobile Engines

Since internal combustion engines were first used to drive motor cars, designers have sought to increase the power output per unit of piston displacement and to increase the reliability of the engine. Great progress has been made along these lines, but today it is necessary for the engine to be not only powerful and reliable, but also economical in its fuel consumption. This demand is of recent origin, and knowledge as to the degree in which fuel consumption is influenced by factors of engine performance is meager.

In the early days of the automobile, a favorite topic for discussion was the influence of spent gases which were allowed to remain in the clearance space at the end of the exhaust stroke. This dilution of the fresh charge was considered to have a bad effect, as is evidenced by the number of scavenging devices which were developed. Most of these devices have been discarded and new methods are being suggested for adding exhaust gas to the induction system, thus increasing the amount of inert gas in the cylinder.

The engineers' attitude seems to have changed from open hostility to toleration, and finally to admiration. The first change is easily explained. Increased power was desired and thorough scavenging made this possible by permitting the introduction of a larger charge. The gain in power, however, failed to justify the cost and complication, and hence the devices were abandoned.

In adding exhaust gas to the induction system a higher thermal efficiency has been the goal. Some investigators have found that increasing the amount of inert gas in the charge tends to prevent fuel knock, and hence enables a high compression ratio to be employed. Since thermal efficiency depends upon the expansion ratio, which in the conventional engine equals the compression ratio, it should be higher with a higher compression ratio. Full throttle tests apparently show such to be the case, and from these results it has been concluded that the addition of exhaust gas will be even more beneficial at part throttle. It is assumed that under such conditions a decrease of power is of no consequence and that the heat of the exhaust may be of considerable aid in vaporizing the fuel. Since in service the automobile engine is operated at part throttle most of the time, it is under this condition that economy of fuel consumption is most important. Therefore, the Bureau has given considerable attention to the effect of admitting exhaust gas under such circumstances.

Nearly all investigators have noted that under light loads the engine will not fire mixtures having as high a rate of air to fuel as that which gives the best economy at higher loads. This is probably because the inert gas with partially opened throttle forms so large a proportion of the total charge. The compression pressure is, of course, also too low, and many experimenters have ascribed the poor efficiency to this cause. To prove that the proportion of the exhaust gas is the predominant influence, an engine partly throttled was operated with the leanest air-fuel ratio with which it would fire regularly. The engine was again operated with a sufficient amount of exhaust gas admitted with the charge to reduce the engine power to the same value as had been obtained in the first test by throttling. Although the pressures in the latter case were considerably higher than before, not nearly as high an air-fuel ratio could be fired and lower thermal efficiency was the result.

It seems fair to conclude, therefore, that the dilution of the charge by the spent gases remaining in the clearance volume makes it impossible at low throttles to employ those air-fuel ratios which, if they could be fired, would yield the maximum efficiency. If the exhaust gas that is present during normal operation forms a barrier to the use of high-efficiency mixtures, then surely the designer ought to avoid any devices for adding still more dead gas to the charge.

Greater Output of Steel in Czechoslovakia

Large allotments of coal permitted a greater output of steel in Czechoslovakia during 1920. Consul C. S. Winans reports a production of 972,976 tons, an increase of 186,954 tons, or 23.8 per cent over the previous year. However, this aggregate is slightly below the total for 1918 and very much below the quantity (1,610,079 tons) produced in 1917.

Business Conditions as the Big Banks of the Country See Them

National City Bank of Chicago Notes Change in Spirit of Business World—Railroads Improved—Credit Problems

There has been some betterment in trade conditions, but the changes from a month ago have been relatively unimportant so far as actual transactions are concerned. But there has been a pronounced improvement in sentiment which accounts for much in a time like this after the whole world has been in a turmoil and various foreign currencies show little gold value. The better feeling has come about through the strong leadership at Washington reflected in a well formulated plan to assist crippled industries and finance the cotton growers, cattle raisers and other hard-pressed borrowers over the producing season. It may be doubted whether any administration move for several years has excited more genuine public support than the emphatic stand taken by President Harding against the enactment of the soldiers bonus law. The clear-cut statement of the reasons for opposing huge payments at a time when the Treasury was experiencing serious difficulty in making both ends meet and when the nation was suffering from burdensome taxation, as well as the confirmatory data given out by the Secretary of the Treasury, were as refreshing as it was unusual. Every student of government finance will endorse the President's attitude for the fact is that the industry, brain-power, and painstaking service in this and other countries is being just about taxed to death. It is also true that any bonus system which committed the government to enormous additional outlays of this kind would react most unfavorably upon the beneficiaries and lead to renewed inflation with ultimately greater disorder and social unrest. This is not a question of politics at all, but cold mathematics which every man, woman and child who will pay this year about $60 each for the expense of running the Federal government will understand if they do a little thinking on their own account.

Price Changes

Readjustment of commodity prices is still underway, but it is evident that the movement in some industries has nearly run its course. The situation in the steel trade is very interesting and suggests that profitable business is so scarce as to make it easy for large buyers to obtain concessions. The average price of eight leading steel products on July 19th was $51.61 as compared with $85.03 at the peak level of last August and $35.80 in August, 1913. This means that prevailing prices are about 44 per cent above the pre-war level and that the industry has made considerable progress in returning to a normal level. Better buying is expected as soon as the government pays over to the railroads the $400,000,000 or $500,000,000 under the agreement to settle various claims growing out of government operation of the transportation industry. Final adjustment of these claims will be of great service also in enabling the roads to wipe out long standing indebtedness and to make heavy purchases of supplies. It is evident, therefore, that the release of these buying orders will cause a revival in industries which for some time past have had relatively little to do.

The Railroads

The outlook for the railroads is distinctly better than it was, for with the 12 per cent wage reductions and lower prices for various supplies production costs will be much less burdensome in the future. Furthermore, the carriers are entering the season in increased earnings through crop moving operations which always mean valuable traffic for many lines. While the total operating revenues in May decreased nearly $13,000,000, operating expenses fell off almost $49,000,000. With these and other changes the roads reported a favorable May balance of $37,080,653 compared with a deficit in May, 1920, of $5,429,769. This is highly reassuring as was also the showing made during the first five months of 1921 when net operating income amounted to $90,382,121 as compared with $26,400,100 for the same months last year. The roads are now in a position to benefit from wage reductions which only became effective last month and from the readjustment of working schedules from the costly war-time basis. Recognition of these changes accounts in part for the quiet buying of railroad securities by large and small investors which has been a prominent factor during the past month.

Limiting Armaments

The coming international conference to discuss the limitation of armament outlays marks a sensible effort to get the great nations to capitalize the remarkable opportunities for such co-operation created by the war. In some respects, therefore, the meeting will be the most important gathering of the kind called for a generation and while no one can tell just what will come out of it, the probability is that far-reaching reforms will be achieved. There never was a more favorable opportunity to stage a conference of this kind, for the world is war weary in a manner and to a degree never seen before. Should it be possible to get the leading nations to limit armaments, there is no doubt but that the resultant savings would be of great value in helping to restore industry to a normal working basis again. This development together with the settlement of the British coal strike and efforts to reach an amicable agreement in Ireland have given new courage to people who have been disheartened by the continuance of enormous disbursements for destructive purposes. There are other indications that the foreign situation is more composed than it was and that consistent progress is being made in various quarters.

Lower Costs

Production costs are being gradually reduced, although the downward trend in some industries is still slow. But all groups of producers as well as all classes of merchants are realizing the need of reducing prices and deflating production costs. This movement is going on all the time, for buyers are resentful of high prices and will not stand for them. There is gradually developing a better co-operation between capital and labor in this country and abroad, and it is to be hoped this will go further—for the waste caused by strikes and lockouts in times like these is about as distressing as anything can be, in a period when official estimates indicate that 5,000,000 people are unemployed.

Credit Situation

As a consequence of continued liquidation in the security markets many long-standing loans have been paid off and the total indebtedness represented by "frozen loans" has been reduced. This has further strengthened the position of the banks, although much remains to be done before conditions become really normal, because the demoralization of the foreign exchanges and the difficulty of securing payment for goods shipped abroad have created exceptional credit burdens. This situation will work out all right in time, for the accounts are being carefully handled and business in this country is getting better. The American banking reserve, however, is exposed not alone to extraordinary demands in financing trade recovery at home, but in a large measure to the much greater requirements of foreign countries whose industrial revival is necessary to sustain our foreign trade. One must, therefore, take a world view of money market requirements in order to judge the credit problem in its proper light. Although possessing the largest gold reserve in the world and showing a marvelous increase in the reserve ratio, we are by no means sufficient unto ourselves as a nation, or in a position to ignore the urgent needs of those countries which are willing to become our best customers. In this regard the money market problem assumes international proportions and must be judged with reference to the extraordinary responsibilities which the United States of 1921 has to consider in helping the world to restore its industrial organism. The American people are living and trading more sensibly than they did a year ago, and while there are many serious problems yet to solve, the outlook today is very much brighter than it was six months ago, or even three months ago.

Trade With Germany Resuming Along Pre-War Lines—Survey of National City Bank of New York

Germany's requirements as to the United States products are apparently unchanged. Details of the 1921 trade of the United States with Germany, just received, show that her habits of reliance upon the United States for manufacturing materials and certain staple articles of food continue as before the war. Total exports from the United States to Germany in the fiscal year just ended—the year ending June 30, 1921—exceed in value those of the pre-war high record year, 1914, the total for the fiscal year 1921 standing at $381,772,000 against $344,794,000 in the fiscal year 1914.

The principal articles forming this big total of our 1921 exports to Germany are practically the same as those prior to the war. They consist chiefly of raw cotton, copper, wheat, meats, and mineral oils in the various forms, though the list of foodstuffs now includes condensed milk, not formerly sent to Germany, while naval stores, cottonseed meal, and tobacco which were sent her formerly are not enumerated by the Department of Commerce among the articles sent to that country in 1921.

Raw cotton is the biggest single article, measured by values, of the 1921 exports to Germany, totaling $104,000,000 out of a grand total of $381,772,000 of all articles exported to that country. In fact, the quantity of cotton sent to Germany in the fiscal year just ended is greater than to any other country in the world except the United Kingdom, and totals 576,000,000 pounds against 210,000,000 in 1920, but is far less than in the year immediately preceding the war when it totaled 1,442,000,000 pounds with a valuation in that year of $182,000,000 against the $104,000,000 in the year just ended. Wheat is the next largest item in the exports to Germany, amounting to $72,000,000 in value in the year just ended (including flour in terms of wheat), as against $4,000,000 last year and less than $11,000,000 in 1914. Lard comes next in the value of the 1921 exports to that country, $41,355,000 against $15,230,000 one year ago and $16,573,000 in 1914. The quantity of copper exported to Germany in 1921 was greater than to any other country of the world, 136,000,000 pounds, valued at $20,283,000 against 112,000,000 pounds to France and 91,000,000 to the United Kingdom. Her food demands upon us are greater than in 1914, the 1921 figures showing bacon $16,000,000 against nothing in the year prior to the war, and condensed milk $6,367,000 as against nothing in the pre-war year. Other articles include canned meats, oleo oil, cottonseed oil and paraffin.

For mineral oils in its various forms, the demand is even greater than prior to the war, especially in lubricating oils of which the total sent to Germany in 1921 amounted to $12,000,000 against $3,000,000 in the year before the war, and of illuminating oil, gasoline and naphthas, the total in 1921 is slightly greater than that of 1920. Of cottonseed oil the value in 1921 exports to that country is a little over $1,000,000 as against one-half million dollars in 1914.

One especially interesting point, adds the bank's statement, in this quick return of Germany to her former trade habits with us is that the growth in our exports to that country has continued up to the very last month, while to practically all other countries exports show a big decline in the closing months of the year under consideration. The total exports to Germany in June, 1921, were in round terms $31,000,000 against $20,000,000 in June of last year, an increase of over 50 per cent, while to Europe as a whole the June exports are 40 per cent below those of the same month of last year.

In our imports from Germany, adds the bank's statement, the tendency to return to pre-war conditions has been less strongly marked, the total imports from Germany in the fiscal year just ended having been but $91,000,000 as against $190,000,000 in 1914, while for the very latest month, June, the total, $7,000,000, is slightly less than in June of last year when it stood at $8½ million dollars.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Boring Tool, (Re-), Cylinder, Van Dresser

International Purchasing and Engineering Co., 2631 Woodward Ave., Detroit, Mich.

"American Machinist," May 26, 1921.

The device consists essentially of a cutter or reamer, a driving and a feeding mechanism for it, a housing, and a base which can be fastened directly to the top of the cylinder to be machined. The size of the reamer is adjustable. The high-speed steel blades are ground helically, and can be adjusted in unison from the lower end of the reamer head without removing the head from the feed bar. The base of the housing is said to be adaptable to any motor. The device may be operated by hand or run by a drill press. The motor cylinders on many cars may be rebored with the motor in place in the chassis. The device is made in seven sizes, to bore cylinders from 2⅞ to 4½ in. in diameter, each size being adaptable to cylinders varying in size ⅜ to ¾ of an inch.

Cutmeter, O-Z

O. Zernickow, 15 Park Row, New York, N. Y.

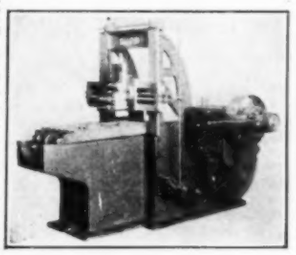
"American Machinist," May 26, 1921.

The device is intended for determining the cutting speed of machine tools of all types. It may also be used for such purposes as ascertaining the speed of rolls in paper mills and the linear speeds of belts and ropes. When in operation, the device is held by means of the handle, and the small wheel is placed in contact with the moving part, the surface speed being shown directly on the dial. The meter operates on the governor principle, and it is said that its accuracy is not affected by changes of temperature, by moisture or by the presence of magnetic fields. A damping mechanism is incorporated, so as to prevent vibration of the indicating hand. By means of the three separate ranges, the device may be used to indicate revolutions per minute from 30 to 1,200, and speeds in feet per minute from 20 to 800.

Planer, Crank, 24 x 24 x 24-Inch

Woodward & Powell Planer Co., 97 Webster St., Worcester, Mass.

"American Machinist," June 2, 1921.

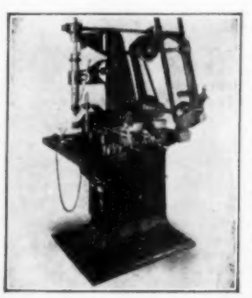


The machine combines the rigidity of the planer with the ability of the shaper to plane to a line and to operate with short, rapid strokes. It is said to be especially adapted to forge shop and railroad shop work. Any length of stroke up to 24½ in. can be taken over any portion of the table. The adjustment can be made while the table is in motion, if desired. The machine can also be furnished with a stroke of 28½ inches. The feeds for cross, vertical, and angular travel are operated by hand or automatically by power, and take place on the return stroke. The planer can be operated by belt on a single pulley connected to a four-speed gear box, as shown; or it can be geared to a motor mounted on top of the gear box. Approximate weight, 8,000 lb.

Drilling Machine, Duplicating, Powers

Sterling Tool and Machine Works, Inc., 205 West 19th St., New York, N. Y.

"American Machinist," June 2, 1921.

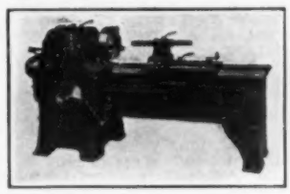


Although adaptable to ordinary drilling, the machine is intended chiefly for the performance of drilling work either requiring the duplication of a part already made, or done directly from a templet or drawing. The rectangular table can be adjusted vertically on dovetail ways. The head or column carrying the spindle can be moved both longitudinally and transversely by means of ball cranks. The spindle is fed by hand and is provided with an adjustable stop. At the right is an arm mounted on the column and holding in two bearings the vertical pilot bar. The master plate is clamped on the table under the pilot, and the work to be drilled under the spindle. By positioning the pilot bar in the holes of the master plate in turn, and moving the table and the spindle, the holes in the work can be made to duplicate those in the master.

Oil-Grooving Machine, Internal, No. 2

Fischer Machine Co., 310 North 11th St., Philadelphia, Pa.

"American Machinist," May 26, 1921.



The machine is intended for the grooving of the internal surfaces of bearings up to 15 in. in diameter and 15 in. in length. It is said to combine the standard features of construction of engine lathes and crank shapers. The bearing in which the oil grooves are to be cut is mounted on a revolving chuck or faceplate, and the boring bar is carried by a block mounted on a reciprocating slide. By different combinations of movements of the tool and work, oil grooves of various types can be produced. The machine is driven by cone pulleys from a countershaft, and it is started by engaging a friction clutch on the drive shaft. In order to cut grooves that are symmetrical, a means of compensating for the errors resulting from the angularity of the connecting rod which transmits the reciprocating motion to the carriage is provided. The machine is equipped with a relieving and taper attachment, to provide for cutting oil grooves in tapered bearings.

Drilling Machine, "Hy-Speed"

Cincinnati Hy-Speed Machine Co., Cincinnati, Ohio.

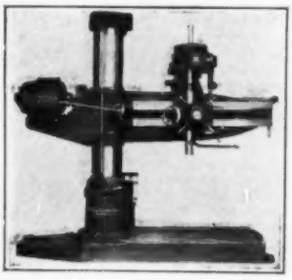
"American Machinist," May 26, 1921.

Among the features of the machine are the single-pulley, overhead drive and the dry-plate clutch operating in connection with the internally clamping, air-cooled brake. By means of a single handle directly in front of the operator, the machine can be instantly started and stopped. The spindle speeds are controlled by a handle on the side of the column. An automatic power feed and an automatic tapping attachment can be arranged on any spindle. Unit construction is embodied in the machine.. The narrow-faced idler pulley is carried directly on the belt shifters and, moving intermittently with the shifters, helps lead the belt from one step to another. The machine is built in various types for either floor or bench use, with a single speed if desired, or with a belted motor drive, an automatic power feed, or an automatic tapping attachment.

Drilling Machine, Radial, Motor-on-Arm Drive

Dreses Machine Tool Co., 227 West McMicken Ave., Cincinnati, Ohio.

"American Machinist," June 2, 1921.

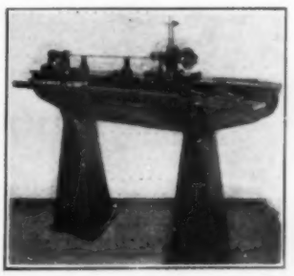


The driving arrangement shown in the illustration has recently been put on the machines made by this concern. The motor, shown fitted to a 5-ft. radial drilling machine, drives the drill and also raises the arm. It is mounted on an extension of the arm, so as to partially balance it; and it is placed on a sub-base, so that different makes of motor can be fitted without a change of the arm. The driving mechanism is very simple. The pinion on the motor meshes directly with a large gear on the horizontal back shaft of the arm. The controller is placed in front of the motor, and the controlling handwheel is brought within easy reach of the operator.

Measuring Machine, Changes in

Pratt & Whitney Co., Hartford, Conn.

"American Machinist," June 2, 1921.



The changed design of pedestal for the 36- and 48- in. machines, retains the rigidity of the older form in a much lighter construction, besides furnishing support to the hardwood shelf in front of the machine. The measuring head is fitted with a clamping arm moved by a tangent screw in the adjustment block, so that when the graduation on the dial is brought almost to line, the clamping screw may be tightened, binding the arm to the dial, and the final adjustment made by means of the tangent screw. An adjustably mounted vernier has been added, and also a permanently mounted glass for the dial reading and vernier. Improvements have also been made in the microscope by means of which the readings from the longitudinal scale are obtained.

Clip, paste on 3 x 5-in. cards and file as desired

Borah's Ideas on Economy and Disarmament

While Germany, defeated and disarmed, is paying thirty-three billions in reparations for the World War, the United States will pay a greater sum for armament, at her present rate, Senator William E. Borah declares in the current number of *The Nation's Business*. Senator Borah cites that fact as a threat of Germany's economic supremacy, unless other nations curb their enormous expenditures for military parade on land and sea.

"Despite her military defeat, Germany, by reason of the short-sighted and blundering policies of the allied and associated powers, may yet secure economic dominance of Europe," Senator Borah says. "Defeat has resulted in Germany's being deprived of her army and her navy. The burden of armaments has been forced from the backs of the German people. They may now devote their energies and their talents to agriculture, to industry, to the arts, to the things which constitute the real wealth and strength of a people. Their genius will find expression not in arms or on the military field, but in improved machinery and co-operative industry. Every ounce of effort which they put forth will be along lines which produce something, which add wealth to the community, which make for contentment and prosperity to the people, which insure greater physical prowess and a higher brain power.

"On the other hand, the allied and associated powers are carrying a vast burden because of their great armies and navies. These burdens are being increased upon a stupendous scale. Hundreds of thousands of their people are to be engaged in lines which produce nothing, add no wealth to the community, make not for health, growth and happiness, but for display, parade and possibly for destruction and death. The German people are compelled to preserve their energies for things which count. The allied and associated powers are burying their people under intolerable taxes, discouraging industry, sterilizing human energy, and breeding discontent through their everlasting plans for increased armaments.

"It is true that Germany has a vast debt upon her for reparation. But this debt is no larger—and perhaps not so large—than our own expenditures as they will be created from year to year for armaments.

"Let us take the figures: Germany is expected to pay an annuity of $500,000,000 plus 26 per cent of the actual value of her exports. As matters now stand the German foreign trade would make this export charge amount to about $260,000,000, which would make her annual payment about $760,000,000. We will assume, however, that her exports will increase, so that at the end of forty years it is estimated that Germany will have paid $33,000,000,000. Look at our expenditures for our military and naval establishments. We expended for military and naval purposes from June 30, 1920, to June 30, 1921, $825,337,939. The Army and Navy bills just passed will incur an expenditure of not less than $830,000,000—perhaps more. This would equal in forty years a little over $33,000,000,000. So we shall pay for our Army and our Navy at the present rate an amount equal to the vast reparation bill which has been assessed against Germany.

"France has an army of 800,000 men. The exact cost of maintaining this great army I do not know, but one can imagine how stupendous it is. The British army and navy combined call for an expenditure much larger than our own. Thus while Germany has her billions of reparation the allied and associated powers are spending their billions for their armies and navies—we alone expending as much for our Army and Navy as the entire reparation claims against Germany.

"The business men of this country must realize, more keenly perhaps than anyone else just now, what these armament expenditures and the taxes thereby imposed mean to business of the future. There is little encouragement for men of business capacity to plan and strive for success when they realize, as they must, that their profits are to be taken for taxes, and that those taxes, when collected, are to be expended, not for things which make for wealth and development, but for sheer waste and sterility. We shall not enjoy that resiliency and revival in business which we are entitled to experience in this country until taxes are brought within reason. And taxes cannot be reduced until expenditures are brought within reason. And public expenditures cannot be reduced until outlays for armaments are brought within reason.

"All that is being done and said just now about reducing the expenses of the Government in other departments and along other lines will amount to very little so far as lifting the burden of the taxpayer is concerned, unless we also cut most savagely the expenditures for armaments, for there is where the vast sum of money goes.

"Neither can we wait, nor need we wait, until all questions about which nations may hold differing views are settled before we begin to limit our armament expenditures. There are now three nations in absolute dominance of the seas—the United States, Great Britain and Japan. These three nations are the only nations which are building vast navies. They are now actually engaged in a naval race. They are building navies with mad speed and piling taxes upon the people at a rate and to an amount never before dreamed of in time of peace and seldom in time of war. To say that these building programs shall go forward, that these taxes shall continue to be increased, and the burdens under which the people are breaking shall be augmented until all international questions about which nations and peoples may hold different views are settled, is to say that there is to be no disarmament.

"Disarmament should not be postponed, or subordinated, or made incident to the settling and adjusting of all international questions. It should be made the controlling, dominating question. It is the most vital problem in the world today. Unless disarmament is effectuated, there is no possible relief from the economic conditions under which we are now suffering. And any plan, or any program, which makes the question of disarmament a subordinate, or incidental proposition, rather than the main and controlling proposition, will result in the future, as it has in the past, in no relief to the taxpayers and no relief from war.

"There are many obstacles to overcome before we can achieve disarmament, or any pronounced limitation of armaments. I do not underestimate the difficulty of overcoming these obstacles. But the obstacle which seems to me the greatest, the obstacle which seems to me the most difficult to master, is one which we will not admit exists, and that is the reliance which we have come to have on force as the only power left on earth with which to govern men.

"I understand fully that there may be circumstances in which an appeal to force is not only necessary but righteous. But to deify force, to make it the dominating factor, to have it ever present, to sit at conference with your finger pointing back over your shoulder to your armies and navies, to intrude into every settlement, and to announce to the world that it is your ultimate reliance, is barbaric—and it is none the less barbaric when it is practiced by professedly Christian nations.

"For myself, I refuse to concede that force is the only power left, or that it should be the dominating and controlling power. It cannot be possible. Reason and justice must still have their place in the affairs of the world, and if leaders and statesmen are strong enough to place their reliance upon them, they will go far. I venture to declare, in the face of professional militarists, that no nation can long defy the public opinion of the civilized world—and especially no government can long defy the public opinion of their own people. And if this conference is conducted as an appeal to the public opinion of the world and to the public opinions of the peoples of the respective countries, it will accomplish far more than if it is conducted under the constant threat of dominating armaments."

EXPORTS OF METAL-WORKING MACHINERY, AS REPORTED BY THE DEPARTMENT OF COMMERCE FOR JUNE, 1921, AND THE FIGURES FOR JUNE, 1920, AS FINALLY REVISED, ARE AS FOLLOWS:

	June, 1920	June, 1921
Metal-working machinery:		
Lathes	$846 583	$131,140
Other machine tools	1,127,297	267,344
Sharpening and grinding machines	395,903	60,499
All other	1,164,940	1,029,230
Total Metal-working machinery	3,534,723	1,488,213
Exported to:		
Belgium	114,881	9,066
France	409,799	161,900
Italy	93,427	8,995
Norway	10,746	2,752
Spain	60,615	7,593
Sweden	68,512	150
United Kingdom	909,168	132,388
Canada	634,333	69,330
Mexico	37,532	74,352
Cuba	40,704	39,597
Brazil	19,955	35,910
Chile	7,402	2,266
China	42,744	59,499
British India	165,884	115,519
Japan	506,074	599,419
Australia	103,450	23,739
Other countries	309,497	145,738

Imports of machine tools were in greater number in June, 1921, than they were in June, 1920, but the value was very much less in June of this year. There were 194 machine tools, valued at $12,204 imported in June, 1921. This compares with 53 machine tools valued at $85,296 imported in June, 1920.

Business Items

The Beacon Visible Pump Co., Louisville, Ky., has been incorporated with a capitalization of $200,000 by J. J. Kasper and A. H. Van Dyke.

The American Washing Machine Co., Muskogee, Okla., has been incorporated with a capital stock of $25,000 by W. F. Bickford, J. M. Sims and E. V. Vernor.

The Sash Weight Foundry Co., Sand Springs, Okla., has been incorporated with a capitalization of $10,000. L. C. Hinds, A. C. Spitznagel and E. M. Tyler are the incorporators.

The Owen Thomas Engine Co., Cleveland, Ohio, has been incorporated with $25,000 capital by George W. Phypers, Murray Smith, L. F. Chapman and others.

The Rochester Automatic Tool Corporation, Rochester, N. Y., has been incorporated with a capital stock of $100,000. Directors include H. F. Stablebrodt, J. J. Appel and M. J. Landau.

The General Motors Products Corp., Philadelphia, Pa., has been incorporated at $1,000,000 by F. R. Hansell, J. Vernon Pimm and E. M. McFarland.

The Baker Ice Machine Co., Fort Worth, Tex., has been incorporated with a capitalization of $25,000 by H. M. Coleman, O. H. Hammer and O. J. Hocher.

The Utah Fuel & Iron Co., Carson City, Utah, has been incorporated at $2,500,000 to develop coal and iron ore lands.

The Automatic Control & Signal Corporation Chicago, Ill., has been incorporated with $500,000 capital stock, by H. B. Bourdette, A. J. Brookins, R. L. Laird.

The Lake Tool Co., Sour Lake, Tex., has been incorporated with $15,000 capital stock by M. L. and M. F. Yount and R. M. Stafford.

The Fitch Vending Machine Co., Buchanan, Va., has been incorporated with $15,000 capital stock, by J. F. Fitch, A. B. Land and O. E. Obenshaim. The company will lease a plant and is reported in the market for some equipment.

The Victor Piston Ring Co., Baltimore, Md., has been incorporated with $500,000 capital stock, by Jackson Brandt, J. E. Butler and others.

The Great West Farm Machines, Ltd., Milverton, Ontario, Canada, has been incorporated to manufacture farm imple-

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

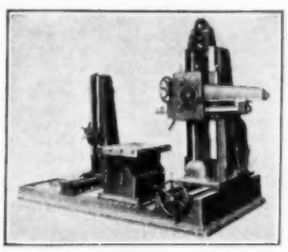
Stamp, Figure, Steel, "All-in-One"
Marburg Brothers, Inc., 90 West St., New York, N. Y.
"American Machinist," June 2, 1921.

These steel figures, or numbering sets, are for stamping figures on metals. The device contains all ten steel figures on the periphery of a steel disk, the figures being hand cut. It is said to be easy to align the figures properly on the work being stamped, because of the fact that they are held on a disk. The proper figure may be easily selected without looking at the cut figure itself, because of the fact that the figures are stamped on the side of the disk, both next to and opposite the cut figures. It is claimed that, besides enabling the operator to do better stamping work, much time may be saved by the use of the device.

Threading Machine, Single-Spindle, "H & G," Model SS
Eastern Machine Screw Corporation, New Haven, Conn.
"American Machinist," June 9, 1921.

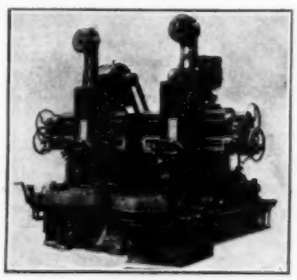
The opening and closing of the dies is automatic and the point at which the action occurs may be adjusted to suit the work. Two styles of work carrier can be provided, one with side-opening jaws, and the other with spring collets for holding the work. Either style is operated by one lever, a single movement of which is all that is required to grip the work and to advance it to the dies. The machine has a capacity for threads up to 1¼ in. in diameter by 9¾ in. long. The gear ratios are 2:1 and ½:1. The bed and pan are cast in one piece and adapted to use on a bench. The machine occupies a space of 14 x 36 in., and when mounted upon the pedestal for floor use the height to the center line of the spindle is 38½ in. The machine is regularly equipped with a countershaft and one die-head. Any H & G die-head from ¼ up to 1¼ in. may be used.

Drilling and Boring Machine, Horizontal, No. 3
Jones Machine Tool Works, Philadelphia, Pa.
"American Machinist," June 9, 1921.



The machine is made in either the standard or the portable type, in which latter case the base for the table is omitted. It is driven by a 3½-hp., variable-speed motor with six geared speed changes, located in the base of the column and flood lubricated, the range of spindle speeds being from 20 to 700 r.p.m. The spindle has a traverse of 20 in. The spindle thrust is carried by large ball bearings. The saddle, which is counterbalanced, has a vertical traverse of 30 in., the horizontal traverse of the column being also 30 in. When the machine is intended for drilling only, the extension of the base, the outer support column and the runway for supporting the boring bar are omitted. The weight of the boring machine is 12,500 lb., and of the drilling machine 9,500 lb.

Boring and Turning Mill, Duplex
Webster & Bennett, Coventry, England.
"American Machinist," June 9, 1921.

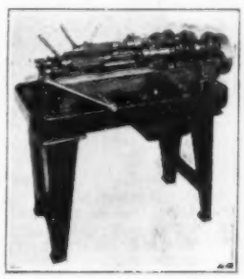


The turret-heads and tables can be run at different speeds, as they operate independently. The machine is made in two sizes, 20-in. and 42-in., the latter being shown. It is driven by means of single pulleys fitted with friction clutches, so arranged that the speed change gears cannot be changed or shifted until the clutches have been released. Positive horizontal, vertical, and angular feeds are provided, and are reversible and interlocking. Rapid power traverse in all directions is instantly available. Any pressure beyond that intended causes the safety clutch to slip and so prevents damage to the feed mechanism. The turret is balanced by compensating springs instead of weights and chains.

Plier, Bushed Joint
Lindquist Engineering Works, Portland, Conn.
"American Machinist," June 2, 1921.

In this plier the joint is somewhat different from the usual construction. Instead of using a single rivet to hold the two parts of the plier together, the rivet passes through a shouldered bushing. One jaw is counterbored to receive the head of the bushing, which is just long enough to reach the bottom of the counterbore in the other jaw. A flat-head rivet passes through the bushing, taking its bearing upon the end of the bushing instead of upon the jaw, so that no matter how tightly the rivet is drawn it cannot bind the jaws and cause them to stick. The method of construction is shown in the sketch.

Threading Machine, Double-Spindle, "H & G," Model DS.
Eastern Machine Screw Corporation, New Haven, Conn.
"American Machinist," June 9, 1921.



The opening and closing of the dies is automatic and the point at which the action occurs may be adjusted to suit the work. Two styles of work carried can be provided, one with side-opening jaws, and the other with spring collets for holding the work. Either style is operated by one lever, a single movement of which is all that is required to grip the work and to advance it to the dies. The machine has two spindles, with five gear ratios ranging from 1:1 to 9:1, and will take the H & G die-heads from ⅜ to 1½ in. in size. It is made only to stand on the floor, occupying a space of 29⅝ x 45½ in., and standing 38 in. from the floor to the center line of the spindles.

Graduating and Marking Machine
Noble and Westbrook Manufacturing Co., Hartford, Conn.
"American Machinist," June 9, 1921.

Either hand or power-driven machines can be furnished. On the power-driven machine, the placing of pieces of work in the machine and removing them when the operation has been performed are the only duties required of the operator. With the hand machine, one turn of the handle completes a piece of work. Provision is made for holding the work in the proper relation to the graduating die and the depth of the marking is controlled by means of a treadle. Parts of various diameters can be graduated by changing the position of the intermediate gear located on the adjustable section. The graduating and numbering are completed in one operation. Full equipment for the machines, including the engraved marking dies, can be furnished.

Lathe, Crankpin, Tosi
Franco Tosi Società Anonima, Legnano, Italy.
"American Machinist," June 9, 1921.

The machine is intended for turning the crank bearings on large multi-throw crankshafts, such as those used in stationary and marine engines. The tools are held by a big hollow mandrel that revolves around the piece to be turned. The main parts of the machine form two separate rigid sets, the fixed one composed of the bench and the mandrel head, and the other composed of the slide, the two supports to hold the shaft to be turned and the shaft itself. The latter set travels longitudinally across the first set on the bed. In order to center the piece which is to be turned, the head can be moved transversly by hand and afterward scured in the position required. There is a continuous circulation of oil between the head and the mandrel, keeping the bearing surfaces cool and lubricated. All levers and gear handwheels are in a central position, within easy reach of the workman.

Clip, paste on 3 x 5-in. cards and file as desired

ments, machinery, tools, etc., with $300,000, by Henry C. Mohr, John Boshart, Enos Nafziger and others.

Alfred Herbert, Ltd., a corporation created under the laws of the United Kingdom, has been granted license to carry on business in Toronto, Canada, as manufacturer and dealer in machinery, tools, boilers, iron, steel and metal products, with $100,000 capital stock and has appointed James C. Blair of Toronto as its representative.

The DeVassie, Beedle & Duffy Auto-motive Grinding Co., Pittsburgh, Pa., has been incorporated with $10,000 capital stock, by H. M. DeVassie, Ingram, Pa., William B. Duffey, E. T. Beedle, Canonsburg, Pa.

The Miller-West Co., Dayton, Ohio, organized with a capital stock of $20,000 formed for manufacture and jobbing of automobile accessories, has been incorporated. Dr. George W. Miller is president and P. E. West, connected with the Dayton and Troy Automobile Company, is secretary and general manager.

The Criterion Automotive Products Co., Dayton, Ohio, with a capital stock of $75,-000 has been incorporated and will take over and enlarge the business of the Criterion Tool and Engineering Co.

Shenango Valley, Pa., iron and steel industries report increased operation. Two important mills that have been shut down for some time reopened with about 3,000 men at work. Four other mills enlarged their working forces.

The Harrisburg Corporation, of Harrisburg, Pa., has acquired a half interest in the plant of the Henry Millar & Henry Co., West York, N. J., manufacturer of gasoline engines and tractors. The business will be enlarged. The Harrisburg Corporation, which has a capital of $1,500,000, controls the Harrisburg Foundry and Machine Co.

The Dayton Irrigation Co., Dayton, Ohio, has been incorporated with $100,000 capital stock for the manufacture of lawn sprinklers, garden sprinklers, etc. John H. Keyes is president, and E. P. Christ, secretary and treasurer.

The Atlas Elevator Device Corporation, Brooklyn, N. Y., has been incorporated with $100,000 capital stock, by E. Weigele, W. H. Dinspel, E. R. Gippert and others.

The U. S. High Speed Steel and Tool Corporation, Green Island, N. Y., has increased its capital stock from 150,000 shares to 200,000 shares.

The Harvard Engineering and Development Co., Cleveland, Ohio, has been incorporated with $25,000 capital stock, by H. P. Hartrath, Joseph S. Krajewski and others.

The American Pli-Nipper Co., Washington, D. C., has been incorporated with $500,000 capital stock to manufacture nippers, etc., by Henry G. Wernimont and others.

The United Iron Works, Kansas City, Mo., has increased its capital stock from $2,500,000 to $3,085,600.

The Waugh Foundry and Machine Works, Williamson, W. Va., has been organized by C. S. Waugh, J. R. Hill and others.

Announcement is made at Hamilton by the International Harvester Co. of Canada, Ltd., that the Chatham works of the company are being made ready to take over the manufacture of motor trucks. Chatham was selected by the company because it was the home of the wagon and sleigh factory of the company.

Lebanon capitalists have purchased from the Bearings Company, of Lancaster, Pa., the Rivetless Chain and Engineering Co., at Avon. The company has a capital of $100,000. The purchasers are Samuel L. Light, Harry H. Light, William H. Worrilow and Thomas S. Quinn.

The Garvin Machine Co., of New York City, announces the resignation of its sales manager, Frank A. Powers, and the appointment of Lyman M. Waite, formerly with the National Acme Co., and recently with the Springfield Automatic Screw Machine Corporation, of Fitchburg, Mass., to succeed him.

Sidney Thompson, president of the Defiance Screw Machine Products Co., has taken over the Napoleon Tool and Machine Co., of Defiance, Ohio and has increased the capitalization to $50,000. The new company will be known as the Napoleon Products Co., and will manufacture auto parts.

Announcement of the incorporation of the Sponsel Universal Joints Company, Washington, D. C., composed of local bankers and business men, with a capital of $4,000,000 under the laws of Delaware, was made last week. Two universal joint patents are owned by the new company, covering the invention of Charles W. Sponsel, consulting engineer. One of the patents is designed for automobile purposes, and the other for general machinery uses. Plans are now being completed for the financing and production of joints by the incorporators. Local offices have been established in the Albee building.

The Allegheny Steel Tank Car Co., Warren, Pa., is going into liquidation and another company, the Conewango Car Co., is being organized to conduct the business.

The Yale & Towne Manufacturing Co., Stamford, Conn., it is reported has installed an electric heated furnace, of two-ton capacity, whereby it will be enabled to make steel and malleable iron castings. Four heats a day may be poured from the furnace, making a total capacity of eight tons a day. The company also is installing a new annealing plant which will contain an arched tunnel through which electric trucks may pass.

The Cincinnati office of the Cutler-Hammer Manufacturing Co., Milwaukee, Wis., has been moved from the Gwynne Building, to the Dixie Terminal Building. A. R. Maujer, formerly of the sales-engineering force of the Pittsburgh office is now in charge of the Cincinnati office.

Pamphlets Received

Airplanes and Safety: The Travelers Insurance Co. of Hartford, Conn. An interesting and instructive booklet on airplane development, presenting an elementary account of the construction and operation of airplanes, and discussing some of the means by which flying may be made a safer mode of travel and transportation.

Handy Wiring Tables and Illumination Data. Issued by the Geo. Cutter Works of the Westinghouse Electric & Mfg. Company, South Bend, Ind. This booklet contains a considerable amount of data which should be of interest to anyone connected with the problems of wiring and lighting offices, factories, etc. Tables of foot candle intensities recommended for different classes of service, are included in this booklet and an interesting discussion of lighting installations is made. Several new devices manufactured by the Westinghouse Company are also shown.

Application of Oil Circuit Breakers. A new publication issued by the Westinghouse Electric & Mfg. Company, East Pittsburgh, known as Special Publication 1643. This includes a complete discussion of the application of circuit breakers, together with an outline of the characteristics of several types of Westinghouse oil circuit breakers.

The Use of Powdered Fuel Under Steam Boilers. A forty-one page pamphlet comprising the address made by Harlow D. Savage, of the Combustion Engineering Corporation, of New York, to the American Iron and Steel Institute. Mr. Savage's address goes into detail regarding the different types of equipment, the actual results obtained up to the present, and is in a sense the story of powdered coal progress. The methods of operation now in use in various plants are described and illustrated with both line drawings and photographs. The results of tests are also given, the authenticity of which are assured by the fact that the tests were run under the direction of the U. S. Government Bureau of Mines.

Radioactivity — New conceptions of the constitution of matter: Research narratives No. 13, published by Engineering Foundation, 29 West 39th St., New York City. A most interesting pamphlet relating the progression of scientific experienment which resulted in the discovery of the X-ray, and later polonium and radium.

Development of Scandinavia - American Trade Relations: One of the foreign commerce series published by the National City Bank of New York; written by F. C. Schwedtman. A lengthy but very interesting discussion of the Scandinavian people, taking up their habits, industries, agriculture and foreign trade.

Personals

Alexander Gabay, formerly tool and efficiency engineer for the Western States Machine Co., Salt Lake City, Utah, has been appointed production manager and assistant superintendent of the Baird Lock Co., Chicago, Ill.

Guy Vaughan has been appointed general manager of the Standard Steel and Roller Bearing Co., of Philadelphia, Pa.

Walter King, formerly connected with the Berger & Carter Co., of San Francisco, Cal., has accepted a position with the Axelson Machine Co. of Los Angeles, Cal., as manager of the lathe department.

J. A. Henry has been appointed western district manager for the Warren Iron and Steel Co., Warren, Ohio. His headquarters will be in Chicago.

Arthur R. Markel, secretary of the Columbus McKinnon Chain Co., Columbus, Ohio, has been made assistant to the president of the company. Don S. Brisbin, formerly assistant sales manager of the McKinnon Industries, Ltd., St. Catharines, Ont., Canada, has been transferred to Columbus as director of sales.

Charles J. Hunter, vice-president and treasurer of the Wheeling Steel and Iron Co., Wheeling, W. Va., has been elected president of the company, succeeding John Duncan who resigned. Mr. Duncan is now actively associated with the Illinois Co. of St. Louis, owner of coal, coke, iron and railroad properties in southern Illinois.

R. H. Scott, vice-president and general manager of the Reo Motor Car Co., Lansing, Mich., has been re-elected president of the Novo Engine Co. also of Lansing.

E. H. Cory, mechanical engineer of Cleveland, Ohio, has taken charge of the Harrisburg Corporation, Harrisburg, Pa., builders of tractors.

E. C. Walton Jr., has succeeded H. F. Vanderburg as purchasing agent of the Cincinnati Ball Crank Co., Oakley, Cincinnati, Ohio. He will also act in his former capacity of employment agent.

Obituary

Jack H. Lewis, of Atlanta, southeastern manager for the Dixon Crucible Co., of New Jersey, died at his home in Atlanta, Aug. 8, from a pistol wound inflicted by himself. A verdict to this effect was returned by a coroner's jury following an inquest. The death of Mr. Lewis followed a long illness which resulted finally in a nervous breakdown. He had been southeastern manager for the Dixon company for some years and was well known in the South.

Forthcoming Meetings

The second International Cost Conference will be held at Cleveland, Ohio, on Sept. 14, 15 and 16, under the auspices of the National Association of Cost Accountants.

The third annual convention and exhibition of the American Society for Steel Treating will be held in the Manufacturers Building, State Fair Grounds, Indianapolis, Ind., during the week of September 19 to 24 inclusive.

The annual congress of the National Safety Council will be held at Boston, Mass., during the week of September 26. C. W. Price, 168 North Michigan Ave., Chicago, Ill., is general manager.

A joint meeting of the American Society of Mechanical Engineers, the Society of Automotive Engineers and the Army Ordnance Association will be held at Aberdeen, Md., Friday, October 7.

The American Gear Manufacturers Association will hold its semi-annual meeting at Rochester, N. Y., October 13, 14 and 15. F. D. Hamlin, 4401 Germantown Ave., Philadelphia, Pa. is secretary.

The National Machine Tool Builders' Association will hold its fall meeting at the Hotel Astor, New York City, October 18, 19 and 20.

NEW *and* ENLARGED

Machine Tools and Machinery Wanted

Machine-tool wants published without charge

N. J., Ampere—The Lock Joint Pipe Co. —one 48 in. 10 gage squaring shear; and 1 small shear for cutting rods.

N. Y., Buffalo—The Day Machinery Co., Exchange and Ellicott Sts., dealers in machine tools—

Open back inclinable and straight side geared presses.

Vertical boring and turning mill from 84 in. to 100 in. swing.

Speedy belted sensitive radial drill press 3 ft. to 4 ft.

Two slip roll forming machines to form a cylinder 5 in. dia., 54 in. to 60 in. long, 14, 16, or 18 gauge, with double friction clutch for reversing.

Power bending brake, 90 in. wide for $\frac{1}{4}$ in. plates.

Power bending roll, Pyramid type, about 98 in. between housings, for $\frac{1}{4}$ in. plate Rolls should be about 7 in. dia.

Single or double punch and shear with capacity to punch $\frac{3}{4}$ in. through $\frac{1}{2}$ in. About 48 in. throat.

Double automatic seaming machine for 16 gauge material, double housing type preferred.

Pa., Philadelphia—Drake Eng. Co., 23 North 10th St., A. Drake, Purch. Agt.—small air compressor, Becker vertical miller, 4 spindle drill, gear cutter and cold saw.

Pa., Philadelphia—G. Miller, 1035 Mt. Vernon St., tool maker and machinist—one 11 ft. engine lathe.

Ga., Tifton—Tifton Handle Mfg. Co., W. E. Chandler, Mgr.—automatic lathe and sander.

Ill., St. Charles—N. Lehr—one speed lathe.

Mich., Detroit—The Universal Gear Wks., Palmer Blvd. and Six Mile Rd., L. G. Berling, Secy.—tools for making and finishing gears.

Mich., Detroit—The Wilton Tool & Mfg. Co., 2121 Grand River Ave., H. Wilton, Pres. —machine tool equipment for the manufacture of special tool steel and finished steel parts for automobiles.

O., Cleveland—The Simmons Mfg. Co., 3405 Perkins Ave.—spot welder (used).

Wis., Milwaukee—The Economy Sheet Metal Wks., 105 5th St., W. Ehmke, Purch. Agt.—one 20 in. and 28 in. roofing folders, and 32 in. square shears.

Wis., Oconomewoc—E. Otto, mill work—hollow chisel mortiser mitre machine.

Mo., Kansas City—The Dennison Engine Co., 200 North Park Ave.—machine shop equipment, including planers, shapers, turret lathe, boring mill, lathe, also shaft straightening machine.

Kan., Pittsburg—The Pittsburg Boiler & Machine Co.—McCabe pneumatic flanging machine for flanging boiler plates.

Ont., Simcoe—C. Blackburn, Colborne St. —tools and machinery for garage, auto repair shop and plant for the manufacture of auto tops.

Ont., Windsor—The Canadian Plant Eng. Co., H. Johnstone, Mgr. — metal working machinery for the manufacture of soot blowers and power equipment.

Md., Baltimore—Hampden Laundry & Ice Mfg. Co., 3648 Hickory Ave., J. H. McFaul, Jr., Secy.—complete laundry and ice manufacturing machinery and complete refrigerating equipment.

N. J., Clayton—The Clayton Automobile Exchange—1 oxy-acetylene cutting torch, power emery grinder, air compressor and tank.

N. J., Woodstown — The South Jersey Farmers Exchange—grinding machinery for fertilizer plant.

N. Y., Buffalo—A. G. Sherman, 235 Highland Ave.—coal conveyor, about 50 ft.

N. Y., Syracuse—The Bd. of Contract & Supply, City Hall, will open bids Aug. 29 for woodworking machinery for the Edward Smith Junior High School, on Lancaster Ave.

Fla., West Palm Beach—Kelsite Stone Products Co., 210 Seward Bldg., H. G. Mitchell, Pres.—machinery for the manufacture of blocks, bricks, roofing tile, wall tile, and similar products.

Ky., Middlesboro—Middlesboro Creamery Co., M. H. Thompson, Purch. Agt.—machinery for use in 40 ton ice plant. Interested in both raw and distilled water plants.

N. C., Garland—Carter & Carter—machinery for the manufacture of brooms.

Tenn., Memphis—Shelby County Training & Industrial School, 225 Madison Ave., L. S. Akers, Secy.—complete laundry equipment.

Ill., Chicago—Bunge Bros. Coal Co., West Lake and North Paulina Sts.—complete equipment for blacksmith and wagon shop.

Ill., Rockford—The Bd. Educ., c/o E. E. Lewis, Supt., will open bids Aug. 26 for manual training equipment, including wood turning lathe and woodworking machinery.

Wis., Green Bay—The Amer. Lumber & Mfg. Co., St. Paul St.—additional wood working machinery.

Wis., Jefferson—C. A. Baumann—belt driven machinery for the manufacture of condensed milk at plant in Lake Mills.

Wis., Milwaukee — The Sonnenberg Sausage Co., 92 Michigan St.—ice machine and refrigerating equipment.

Mo., Monett—E. L. Jerome—machinery for ice cream factory.

Ont., Tillsonburg—R. Myrick—machinery and equipment, both steam driven and electrically operated, for making butter.

Ont., Woodstock—Warren & Son—$40,000 worth of machinery and equipment for the manufacture of organs.

Metal Working Shops

NEW ENGLAND STATES

Conn., Hartford — The City Health & Charity Dept. will soon award the contract for the construction of a 2 story, 43 x 63 ft. laundry and central heaing plant, etc., on Holcomb St. Estimated cost, $80,000. Whiton & McMahon, 36 Pearl St., Archts. Noted Feb. 17.

Conn., New Haven—W. E. Malley, 305 St. Ronan St., will soon award the contract for the construction of a 1 story, 60 x 140 ft. garage, etc., on George St., Brown & Van Beren, 185 Church St., Archts.

Conn., Wallingford—H. L. Judd Co., 42 South Cherry St, manufacturer of hardware, is having plans prepared for the construction of an addition to its factory. Estimated cost, $100,000. Lockwood, Greene & Co., 101 Park Ave., New York City, Archts. and Engrs.

Mass., Springfield—The Noyes-Buick Co., 758 Main St., will build a 1 story, 100 x 185 ft. garage, etc., on Main St. Estimated cost, $125,000. Private plans.

Mass., Springfield—W. Sacks, 131 Main St., has awarded the contract for the construction of a 1 story, 100 x 100 ft. garage, etc., on Worthington St.

Mass., Worcester—The Worcester Electric Light Co., 11 Foster St., has awarded the contract for the construction of a 2 story machine shop, on Webster St. Estimated cost, $35,000.

R. I., Providence—Monks & Johnson, Archts., 99 Chauncy St., Boston, Mass., are receiving bids for the construction of a 1 story factory for the manufacture of emblems on the block bounded by Highland Ave., North Main, 3rd and 4th Sts., for Williams & Anderson Co., 33 Broad St. Estimated cost, $60,000.

R. I., Woonsocket—The Shambow Shuttle Co., 583 Main St., has awarded the contract for the construction of a 3 story, 84 x 158 ft. plant on North Main St., for the manufacture of shuttles. Estimated cost, $125,000.

MIDDLE ATLANTIC STATES

N. J., Bridgeton—J. Toye Co., 353 Bank St., has had plans prepared for the construction of a 1 story, 40 x 80 ft. foundry. Estimated cost, $12,000.

N. J., Camden—The Bd. Educ., City Hall, will receive bids until Aug. 22, for the construction of a printing shop for the Junior High School, on Newton Ave.

N. Y., New York—The Fordham Plaza Auto Co., Inc., 1856 Bath Ave., Brooklyn, is having plans prepared for the construction of a 3 story, 100 x 160 ft. garage on Wester Ave. near 189th St., here. Estimated cost, $150,000. C. Clark, 441 Tremont Ave., Archt. and Engr.

N. Y., Syracuse—The Meldrum-Gabrielson Corp., Industrial Bldg., has awarded the contract for the construction of a 1 and 2 story, 60 x 160 ft. factory on West Fayette St., for the manufacture of milling machines. Estimated cost, $75,000.

SOUTHERN STATES

Fla., Oldsmar—The Oldsmar Tractor Co. plans to build an addition to plant which will be used as a foundry. H. J. Keller, Mgr.

MIDDLE WEST STATES

Ill., Chicago — H. T. McFarlane, 532 South Canal St., has awarded the contract for the construction of a 6 story, 115 x 116 ft. factory, on Green and Van Buren Sts. for the manufacture of auto bodies. Estimated cost, $400,000.

Ill., Chicago—The Niagara Radiator & Boiler Co., North Tonawanda, N. Y., is having plans prepared and will soon receive bids for the construction of a 1 story, 140 x 175 ft. foundry, on 63d and Woodlawn Sts., here. Estimated cost, $100,000. E. C. Andrews, Pres. Private plans.

THE WEEKLY PRICE GUIDE

This Week's Market

Steel prices in New York warehouses remain unchanged. The general tone of the warehouse business is optimistic, despite the very light demand for finished steel at the mills. The official Pittsburgh schedule of $1.75 for bars and $1.85 for plates and shapes continues. Mill shipments, New York, of shapes and plates are quoted at $2.18 to $2.23; bars at $2.13. Pig iron, Birmingham No. 2 foundry, is quoted at $20 as against $19, f.o.b. furnace.

New York quotes tin at 26c. as against 26¼c. per lb., and a reduction of ½c. per lb. on zinc sheets in casks. Prices in Chicago are the same as those in New York on copper and brass sheets, brass rods and tubing and copper bars. Long terne plate has dropped from $7.70 to $6.75 and Swedish iron has advanced from 17½c. to 18½c. per lb. Cleveland reports decreases of 1c. per lb. in copper wire and tubing, 2c. per lb. in brass tubing and ½c. per lb. in brass rods.

Linseed oil has dropped from 84c. to 80c. per gal. (5 bbl. lots) in Chicago.

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	†$24.50
Northern Basic	21.52
Southern Ohio No. 2	22.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	†30.26
BIRMINGHAM	
No. 2 Foundry	*20.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25–2.75	†21.76
Virginia No. 2	†28.74
Basic	†20.26
Grey Forge	†22.26
CHICAGO	
No. 2 Foundry local	*20.00
No. 2 Foundry, Southern, sil 2.25@2.75	†26.66
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	21.96
Basic	19.96
Bessemer	21.96

* F. o. b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York Delivered	Cleveland	Chicago Delivered
Structural shapes	$2.88	$2.74	$2.88
Soft steel bars	2.78	2.64	2.70
Soft steel bar shapes	2.78	2.64	2.70
Soft steel bands	3.43	....	....
Tank plates	2.88	2.74	2.88

BAR IRON—Prices per 100 lb. at the places named are as follows:

Mill, Pittsburgh (refined)	$2.50
Warehouse, New York, delivered	2.78
Warehouse, Cleveland	3.52
Warehouse, Chicago	2.78

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York,	Cleveland	Chicago
No. 10	3.10	3.53	3.25	3.53
No. 12	3.15	3.58	3.30	3.58
No. 14	3.20	3.63	3.35	3.63
No. 16	3.30	3.75	3.45	3.73
Black				
Nos. 17 and 21	3.75	4.05	3.80	4.45
Nos. 22 and 24	3.85	4.10	3.85	4.50
No. 25 and 26	3.90	4.15	3.90	4.55
No. 28	4.00	4.25	4.00	4.65
Galvanized				
No. 10 and 11	4.00	4.25	4.00	4.95
No. 12 to 14	4.10	4.35	4.10	5.05
Nos. 17 and 21	4.40	4.65	4.40	5.35
Nos. 22 and 24	4.55	4.80	4.55	5.50
No. 26	4.70	4.95	4.70	5.55
No. 28	5.00	5.25	5.00	5.65

COLD FINISHED STEEL—Warehouse base prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb	$4.23	$4.23	$4.00
Flats, squares and hexagons, per 100 lb	4.73	4.73	4.50

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	55@60%
Cleveland	55%
Chicago	50%

Electric Welding Wire—Welding wire in 100-lb. lots sells as follows, f.o.b. New York: 1/32, 8½c. per lb.; ⅛, 7.15; 5/32 to ¼, 6.75. Swedish iron in Chicago sells for 18½c per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York	Cleveland	Chicago
Openhearth spring steel	5.00	6.50	8.25
Spring steel (light)	8.00	6.50	10.50
Coppered Bessemer rods (base)	8.00	8.00	6.03
Hoop steel	3.88	3.29	3.48
Cold rolled strip steel	7.50	8.25	7.25
Floor plates	4.85	3.09	5.23

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card of July 7, 1921:

BUTT WELD

Inches	Steel Black	Galv.	Inches	Iron Black	Galv.
1 to 3	64½	52	⅛ to 1¼	39½	24½

LAP WELD

2	56½	44	2	34½	20½
2½ to 6	60½	48	2½ to 4	37½	24½
7 to 12	57½	44	4½ to 6	37½	24½
13 and 14	45	37	7 to 12	35½	22½
15	42½	32			

BUTT WELD, EXTRA STRONG, PLAIN ENDS

1 to 1½	62½	51	1 to 1½	39½	25½
2 to 3	63½	52			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	54½	43	2	35½	22½
2½ to 4	58½	47	2½ to 4	38½	26½
4½ to 6	57½	46	4½ to 6	37½	25½
7 to 8	53½	40	7 to 8	30½	18½
9 to 12	48½	35	9 to 12	25½	13½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

Copper, electrolytic	12½@13
Tin in 5-ton lots	26.00
Lead	4.75
Zinc	5.00
ST. LOUIS	
Lead	4.35
Zinc	4.60

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York	Cleveland	Chicago
Copper sheets, base	20.00	20½@21	20.00
Copper wire (carload lots)	15.50	15.50	14.00
Brass sheets	15.75	18.00	15.75
Brass pipe	18.50	20.00	18.50
Solder (half and half) (case lots)	17.75	20.25	17.50

Copper sheets quoted, above hot rolled 24 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are in cents per pound at warehouse:

New York	13.75
Cleveland	15.50
Chicago	13.75

NICKEL AND MONEL METAL—Base prices in cents per pound, any quantities, f.o.b. Bayonne, N. J.

Nickel	
Ingots and shot	41
Electrolytic	44

Monel Metal			
Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Cold drawn rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55

Special Nickel and Alloys	
Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

SHOP MATERIALS & SUPPLIES

ZINC SHEETS—The following prices in cents per pound are f. o. b. mill less 8% for carload lots..... 10.00

	Warehouse	
	In Casks	Broken Lots
New York	11.00	12.00
Cleveland	11.15	11.50
Chicago	15.75	16.25

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

New York	5.25
Chicago	6.00
Cleveland	6.00

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	9.50	9.50	$9.50
Copper, heavy, and wire	9.00	9.00	9.00
Copper, light, and bottoms	7.00	7.00	7.00
Lead, heavy	3.25	3.50	3.00
Lead, tea	2.00	2.50	2.00
Brass, heavy	5.00	5.00	7.25
Brass, light	4.00	4.00	4.25
No. 1 yellow brass turnings	4.50	4.00	4.50
Zinc	2.50	2.50	2.50

ALUMINUM—The following prices f. o. b. shipping point in cents per pound:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb.	25.00	25.00@26.00	30.00

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current
New York (round)	18.50
Chicago	18.50
Cleveland	22.00

BABBITT METAL—Warehouse price in cents per pound:

	New York	Cleveland	Chicago
Best grade	70.00	35.50	35.00
Commercial	30.00	13.50	9.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York, we quote the best two grades, although lower grades may be obtained at much lower prices.

SHOP SUPPLIES

This market is very soft, and our quotations for the present are useful only as a guide.

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York	Cleveland	Chicago
Hot pressed square	2.00	$2.25	3.00
Hot pressed hexagon	2.00	2.25	3.00
Cold punched hexagon	1.50	2.25	3.00
Cold punched square	1.50	2.25	3.00

Semi-finished nuts, ⅝ and smaller, sell at the following discounts from list price:

	Current
New York	75%
Chicago	50%
Cleveland	80%

MACHINE BOLTS—Warehouse, discounts in the following cities:

	New York	Cleveland	Chicago
All sizes up to 1 by 30 in.	50%	60–10%	60%
1¼ and 1½ in. by 3 in. up to 12 in.	40%	50–5%	55%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York..... $3.00 Cleveland..... $4.50 Chicago..... $4.50
For cast-iron washers, ¼ and larger, the base price per 100 lb. is as follows:
New York..... $4.25 Cleveland..... $3.75 Chicago..... $4.50

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
½ by 6 in. and smaller	50%	60%	55%
Larger and longer up to 1 in. by 30 in.	45%	50–10%	50–5%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets	Burs
Cleveland	40–10%	10%
Chicago	50%	50%
New York	50–10%	25–10%

RIVETS—The following discounts are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅝ and smaller	50–10%	60–10%	60–10%
Tinned	50–10%	60–10%	45%

Structural, ¼, ½, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York...$4.40 Cleveland...$3.90 Chicago....$3.68 Pittsburgh..$2.65
Boiler, same sizes:
New York...$4.50 Cleveland...$4.00 Chicago....$3.78 Pittsburgh..$2.75

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	19.00	23.00	20.00
Brass	18.50	20.00	18.50

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ⅛-2 in., inclusive in rounds, and ⅛-1½ in., inclusive in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $0.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $6.75 per 100 lb. In Cleveland—$5.50 per 100 lb.; New York price is $7.25.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	Cleveland	Chicago
White	7.50@10.00	8.50@11.00	12.00
Colored mixed	5.50@ 9.00	6.50@10.00	10.00

WIPING CLOTHS—Jobbers' price

	13½x13½	13½x20½
Cleveland, per 1,000	$55.00	$65.00
Chicago, per lb	.11½	.11½

SAL SODA sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.10
Philadelphia (5 bbl)	1.85
Cleveland	3.00
Chicago	2.65

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.55
Philadelphia (5 bbl.)	2.55
Chicago	2.75

COKE—The following are prices per net ton at ovens, Connellsville:

	Current
Prompt furnace	$2.90@$3.00
Prompt foundry	4.00@ 4.50

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	100-lb. bag	$0.80
Cleveland	100-lb. bag	0.80

LINSEED OIL—These prices are per gallon:

	Current		
	New York	Cleveland	Chicago
Raw in barrels (5 bbl. lots)	$0.78	$0.83	$0.80
5-gal. cans	.81*	.98	1.00

*Charge of $2.25 for two cans.

WHITE AND RED LEAD—Base price per pound:

	Current		
	Red		White
	Dry	In Oil	Dry and In Oil
100 lb. keg	12.25	13.75	12.25
25 and 50-lb. kegs	12.50	14.00	12.50
12½-lb. keg	12.75	14.25	12.75
5-lb. cans	15.25	16.75	15.25
1-lb. cans	17.25	18.75	17.25

500-lb. lots less 10% discount; 2,000-lb. lots less 10-4% discount; 10,000 lb. lots less 10-7½% discount. Business is good in white lead.

Ill., Chicago—The Seventh St. Building Corp., c/o W. Jordan, 110 South Dearborn St., has awarded the contract for the construction of a 1 story, 112 x 165 ft. garage at 704-12 South Wabash Ave. Estimated cost, $60,000.

Ill., Chicago—B. H. Stephens, Archt., 37 West Van Buren St., is receiving bids for the construction of a 1 story, 208 x 230 ft. factory on Lake and Albany Aves., for the manufacture of ball bearings, for the G. A. Ball Bearing Co., 3051 West Lake St. Estimated cost, $65,000.

Ill., Chicago—W. G. Uffendell, Archt., 39 South State St., will receive bids until about Sept. 15 for the construction of a 3 story, 75 x 200 ft. garage at 4616 Winthrop St., for the Sheridan-Wilson Garage Co., 64 West Randolph St. Estimated cost, $150,000.

Ill., Chicago—The Yellow Cab Co., 57 East 21st St., will soon award the contract for the construction of a 1 story, 140 x 250 ft. garage. Estimated cost, $100,000. J. Herts, W. C. Bennett, c/o owner, Archt.

O., Cleveland—The Bryant Auto Co., 3191 West 25th St., has awarded the contract for the construction of a 3 story, 80 x 180 ft. garage on West 25th St. near Clark Ave. Estimated cost, $150,000. Noted July 28.

O., Cleveland—The Cretney Co., 14453 Euclid Ave., has awarded the contract for the construction of a 2 story garage on Euclid and Eastham Aves. Estimated cost, $50,000.

O., Cleveland—S. Glazer, 603 Republic Bldg., plans to build a 1 story, 65 x 140 ft. garage on Euclid Ave. near East 105th St. Estimated cost, $60,000. E. A. Curtis, Republic Bldg., Archt.

O., Cleveland—The International Steel Tie Co., 16702 Waterloo Rd., plans to build a 1 story, 40 x 120 ft. factory, on Waterloo Rd. Estimated cost, $40,000. W. C. Mahon, Secy. Private plans.

O., Cleveland—M. L. and I. G. Kohn, 722 Natl. City Bldg., plan to build a 3 story, 100 x 140 ft. garage on Carnegie Ave. and East 36th St. Estimated cost, $100,000. Private plans.

O., Cleveland—Koller Bros., 724 Prospect Ave., manufacturers of plumbing supplies, are receiving bids for the construction of a 1 story, 50 x 106 ft. garage, at 703 Huron Rd. Estimated cost, $50,000. J. L. Cameron, 10406 Euclid Ave., Archt.

O., Columbus—The Union Boiler Wks., 57 South Center St., is having plans prepared for the construction of a 1 story boiler factory on Goodall St. Estimated cost, $8,500. Private plans. Noted Aug. 11.

O., Shaker Heights—The Moreland Development Co., c/o O. P. Van Swearingen, Marshall Bldg., Cleveland, is having plans prepared for the construction of a 4 story garage and commercial building, on Shaker Blvd. and Market St., here. Estimated cost, $250,000. A. W. Harris, Schofield Bldg., Cleveland, Archt.

Wis., Milwaukee—The Milwaukee-Western Fuel Co., 120 Wisconsin St., will soon award the contract for the construction of a 1 and 2 story, 136 x 140 ft. garage, on South Pierce and Clinton Sts. Estimated cost, between $90,000 and $100,000. Klug & Smith, 69 Wisconsin St., Archts. and Engrs.

WEST OF THE MISSISSIPPI

Minn., Minneapolis—The Pence Auto Co., 8th St. and Hennepin Ave., has awarded the contract for the construction of a 1 story, 100 x 220 ft. factory, at 2401 Bway. Estimated cost, $65,000. H. E. Pence, Pres.

Mo., Joplin—Nuhels Wire & Sheet Metal Co. plans to build a 50 x 200 ft. factory at 513 East 5th St.

Mo., St. Louis—The Standard Stamping Co., c/o G. Wiegand, 2000 North Bway., will soon award the contract for the construction of a 1 story, 107 x 132 ft. enameling plant on Bway. and Madison St. Estimated cost, $50,000. Klipstein & Rathman, Chemical Bldg., Archts.

Tex., College Station—The State has awarded the contract for the construction of an engineering shop and 2 agricultural buildings, at the A. & M. College, here. Estimated cost, $400,000.

WESTERN STATES

Cal., Burbank — The Amer. Aluminum Products Co., c/o R. D. King, Archt., 519 Van Nuys Bldg., is having plans prepared for the construction of seven 1 story factories, covering 60,000 sq.ft. of floor space. Estimated cost, $150,000.

Cal., Los Angeles—The Angelus Sanitary Machine Co., San Fernando Bldg., has awarded the contract for the construction of a 1 story 90 x 160 ft. can factory. Estimated cost, $35,000.

CANADA

Ont., Windsor—The Canadian Planet Eng. Co. plans to build and equip a plant for the manufacture of soot blowers and power equipment. Estimated cost, $75,000. H. Johnstone, Mgr.

In July

we published the names, addresses and requirements of 133 concerns in the market for

Machine Tools and Machinery

This service is both expensive and difficult to maintain, but we *have reason* to believe that it is of value to the readers of the *American Machinist*, and is appreciated by them.

These leads are not easy to obtain, even by our carefully instructed field force. Our men are instructed to verify beyond doubt every item of information reported for publication in these columns. We use no newspaper clippings, no hearsay, no rumors; only the machine-tool and machinery requirements given us by the concerns first hand, or sent in by our regular correspondents.

If you are in the market, or if any of your friends are in need of new equipment, take advantage of our

Machine-Tool and Machinery Exchange

General Manufacturing

NEW ENGLAND STATES

Conn., Hartford—Buck & Sheldon, Inc., Archts. and Engrs., 60 Prospect St., are receiving bids for remodeling plant on Pearl and South Ann Sts., for K. B. Noble Co., 249 Pearl St., manufacturers of contractors' equipment and machinery. Estimated cost, between $25,000 and $30,000.

Conn., Hartford—The United States Envelope Co., Cypress St., Springfield, Mass, has awarded the contract for alterations to factory, on Pearl St. Estimated cost, between $50,000 and $60,000.

Me., Dexter—D. Whiting & Sons, Charlestown, Mass., have awarded the contract for rebuilding their creamery on Grove St., which was recently destroyed by fire. Estimated cost, $25,000. Noted June 23.

Mass., Malden (Boston P. O.)—The Revere Knitting Mills have awarded the contract for the construction of a 2 story, 50 x 100 ft. factory on Eastern Ave. Estimated cost, $50,000.

MIDDLE ATLANTIC STATES

N. J., Woodstown—The South Jersey Farmers Exchange will build a 1 story, 80 x 200 ft. fertilizing plant and warehouse along railroad tracks. Estimated cost, $50,000.

Pa., Appollo—McCrery San-Collapsible Barrel Co. has awarded the contract for the construction of a 1 story, 50 x 160 ft. factory. Estimated cost, $40,000.

Pa., Phila.—The Brighton Worsted Co., Tioga and D. Sts., is receiving bids for the construction of a 3 story, 32 x 55 ft. factory. Estimated cost, $70,000. Private plans. Noted Aug. 11.

Pa., Sunbury—The Butter Krust Baking Co., c/o B. Apple, has had plans prepared for the construction of a 2 story, 70 x 130 ft. bakery at 249 Eckman St. Estimated cost, $150,000. W. H. Leed, 32 South 16th St., Phila., Archt.

SOUTHERN STATES

Fla., Lakeland — The Federal Ice Co., Blue Island Ave., has awarded the contract for the construction of a 2 story, 100 x 350 ft. ice plant, including 3 storage rooms, with 300 ton capacity. Estimated cost, between $250,000 and $300,000.

MIDDLE WEST STATES

Ill., Chicago—Schmidt, Garden & Martin, Archts., 104 South Michigan Ave., are receiving bids for the construction of a 4 story, 54 x 72 ft. sausage factory at 1743 Larrabee St., for Hetzel & Co., 739 Larrabee St. Estimated cost, $85,000.

Ill., Lawrenceville — The Lawrenceville Cooperage Co. has awarded the contract for the construction of a 1 story, 40 x 100 ft. factory. Estimated cost, $50,000.

O., Cleveland—The Ohio Provision Co., 6201 Walworth Ave., has awarded the contract for the construction of a 2 story, 45 x 101 ft. factory. Estimated cost, $40,000.

O., Columbus—The Columbus Show Case Co., 423 North Grant Ave., has awarded the contract for the construction of a 1, 2 and 3 story, 52 x 84 ft. addition to factory. Estimated cost, $40,000.

Wis., Milwaukee—The Best Block Co., 1228 Humboldt Ave., will soon award the contract for the construction of a 1 story, 50 x 60 ft. factory, (1st unit), on North Pierce and Keefe Aves. Estimated cost, $40,000. J. Menge, 296 West Water St., Archt.

WEST OF THE MISSISSIPPI

Kan., Pittsburg—Tabler Bros. have awarded the contract for the construction of a cold storage plant. Estimated cost, $150,000.

CANADA

Ont., Windsor—The Essex Provision Co., Ltd., 1120 McDougall St., will soon award the contract for the construction of a 2 story, 125 x 400 ft. cold storage plant on McDougal St. Estimated cost, $600,000. Colthurst, Trace & Nichols, 16 Sandwich St., W., Archts.

Ont., Galt—The Galt Amateur Athletic Assn. is having plans prepared for the construction of a 1 story, 130 x 240 ft. artificial ice rink on Shade St. Estimated cost, $150,000. F. C. Bodley, Commercial Chambers, Brantford, Archt.